Local inquiry and alternative knowledge: cognitive dimensions of the sustainable agriculture movement

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study.
ABSTRACT

This study analyzes the experiential and cognitive practices of a group of alternative agriculturists in the North Central region as a concrete expression of a grassroots social movement, which is critical of conventional agriculture, and seeks a new knowledge base for social change in the U.S. agricultural landscape. The study inventories inquiries that alternative agriculturists in the North Central region make to ATTRA (Appropriate Technology Transfer to Rural Areas), a USDA funded alternative agricultural information center based in Fayetteville, Arkansas. The purpose is to determine whether the ideational and value dimensions of the inquiries are congruent with the knowledge interests reflected in alternative agriculturists experimental and cognitive activities. Two theoretical perspectives, social movement theory and sociology of knowledge, ground the study.

Aided by NUD*IST, a qualitative research software, I employ an interpretive, hermeneutically informed process of “reading” and interpreting symbolic meanings embedded in textual discourse to analyze the experiential and cognitive practices of alternative agriculturists. I also use a keyword search strategy to determine the ideational and value dimensions of inquiries to ATTRA.

Alternative agriculturists' cognitive practices show ideological precepts about stewardship, social justice, and human relationships with nature, are not necessarily irreconcilable with reason and creativity. Farmers are creating and disseminating critical
new knowledge. However, that creative process is firmly guided and shaped by underlying ideological world-views about their ecological and social environments. The processes are integrally linked. They also neither reject the possibility of conventional scientific agricultural knowledge nor reify local knowledge. Rather, they continue to learn through their local and situation specific experimentation, the most effective approaches to selectively combining diverse kinds of agricultural knowledge in ways that work for them both philosophically and pragmatically.

While the imperatives of financial and material sustainability underpin initial shifts towards alternative management practices, the interpretive analysis illuminate a concern for the quality and perpetuity of our environmental capitals - water quality, soil quality and ecological diversity, and social capital.

This analysis also crystallizes the functional importance of resources in risky shifts. As farmers transition to alternative agricultural systems, institutional support structures are pivotal in sustaining farmer behavior.
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In the late 1960s, venerable activists like Robert Rodale (1970) and Wendell Berry (1977; 1981) recognized the “invisible” farmers whose production practices depended on systemic management of nature, applying ecological knowledge produced through practice and accumulated personal experience. After two decades of institutional neglect, advocates of sustainable agriculture are redirecting attention to those “invisible farmers” as important repositories of alternative agricultural knowledge (Gerber, 1992; Dlott, Altieri and Masumoto, 1994; Pretty, 1991; Merrill-Sands and Collinson, 1994; Hassanein and Kloppenburg, 1995).

The locality-specific actions and social organizational processes of those “invisible farmers” are a concrete expression of a social movement, critical of conventional agriculture, which seeks a new knowledge base for social change in the U.S. agricultural landscape. After decades of persistence at the margins of mainstream agricultural discourse, those farmers, who I describe in this study as alternative agriculturists, have gained visibility as actors who can make important contributions to the ecological health and overall sustainability of the natural resource base.

As interest in sustainable agriculture has gained momentum, so has the need to understand how their locally grounded practices and modes of social organization of have contributed to the creation of an alternative agricultural knowledge base at
the grassroots. The need has grown with increasing recognition of the extent to which that knowledge is little understood, or systematically documented. This research is formulated in the spirit of that emergent need. The purpose is to study two groups of social actors interested in alternative agricultural knowledge in the North Central Region- those who create alternative agricultural knowledge, and those who seek knowledge through alternative agricultural information agencies.

The two groups of agricultural actors selected for this research are farmers who have participated in the North Central Region SARE\(^1\) Producer Grant Program, and ATTRA's\(^2\) agricultural clients in the North Central Region. The objectives of the study are

1. To interpret the local experiential knowledge generated by SARE farmer-researchers in order to understand how that knowledge contributes to an alternative agricultural knowledge base at the grassroots.

2. To identify and describe the social organizational process by which alternative agricultural knowledge generated by SARE farmer-researchers is moved from

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\(^1\) SARE stands for sustainable agriculture research and education. It is a federal program authorized by the 1985 Farm Bill to provide funding for research carried out by scientists, producers, educators and private sector entities interested in sustainable agriculture. Its mission is to increase knowledge about sustainable agriculture, and help agricultural producers adopt alternative agricultural technologies that can have long term ecological social benefits.

\(^2\) ATTRA (Alternative Technology Transfer for Rural Areas) is a federally supported alternative agricultural information center based in Fayetteville, Arkansas. ATTRA collects, documents and disseminates alternative agricultural knowledge to clients who make requests through a toll free telephone connection throughout the United States and internationally.
its local contexts of creation and is validated, shared and disseminated among the larger community of agriculturists.

3. To inventory and analyze alternative agricultural knowledge-related inquiries from the North Central region to ATTRA (Appropriate Technology Transfer to Rural Areas) in order to understand its cognitive and value dimensions.

4. To determine whether and to what extent the inquiries to ATTRA are congruent with the knowledge interests reflected in SARE farmer-researchers' reports.

5. To show how the cognitive practices and social organizational processes of alternative agriculturists reflect a grassroots social movement for social change in the agricultural landscape.

**Context of the Study**

In 1988, the USDA launched its Regional Sustainable Agriculture Research and Education Program, a competitive grant program to support research on sustainable agriculture processes and technologies. While initially dominated by land grant scientists, the North Central Region took the initiative in 1992 to expand its program to directly include local producers through a special Producer Grant Program. The program provides financial support to farmers interested in local inquiry on sustainable agricultural problems of direct relevance to their farming conditions.

From 1992 to 1995 the North Central SARE Producer Grant program awarded a total of one hundred and fifty eight grants to farmers to support their on-farm inquiry on alternative knowledge and technology (Operations Committee
Report, 1997). The main interests of these farmers, whom I describe in the context of this study as SARE farmer-researchers, is to generate agricultural knowledge that reconciles their environmental health and quality of life concerns with the economic viability of their farms (Gerber, 1992; Rosmann, 1994).

Another group of North Central Region agricultural actors equally interested in alternative agriculture knowledge who seek rather than consciously engage in creating knowledge, are ATTRA clients. ATTRA responds to inquiries from clients interested in implementing sustainable agricultural practices by developing information packages directly tailored to the interests of those clients. These two groups of agricultural actors are related in that both reflect an interest in agricultural knowledge not readily available through the conventional scientific agricultural knowledge system.

Increased interest in sustainable agriculture in the last decade has also garnered greater interest in terms of the kinds of agriculture practiced and the kinds of knowledge generated by these groups. A study of the cognitive dimensions of the experiential knowledge that these social actors seek and the knowledge they create from their local inquiry can contribute to redressing the relative dearth of systematic knowledge on alternative agriculture in U.S. Moreover, it may hold important implications for promoting the understanding of sustainable agriculture knowledge within the broader agricultural community. Institutional support of sustainable agriculture, evidenced by programs like SARE and ATTRA, suggests a need to understand the knowledge interests and requirements of alternative agriculturists in order to usefully guide future policies and actions.
Another important context relates to the agency exhibited by agricultural actors as they seek knowledge that can support their goals to establish environmentally and socially viable agricultural systems. Their collective participation in these programs reflects a partial rejection of the dominant agricultural knowledge system and a local expression of a social movement, even though they may not perceive themselves as social movement actors. The primary challenge in this study thus, is to empirically identify how agricultural actors' cognitive processes link to their social activism embodied in their modes of social organization for creating and sharing knowledge.

**Justification for the Study**

The local knowledge that alternative agriculturists create is a rich resource for expanding the knowledge base of agriculture in the U.S. Kloppenburg (1991) refers to it as “a reconstructive project” for a truly sustainable agriculture. Indeed a truly sustainable agriculture, as Flora (1998a) suggests, reflects an approach to production that values environmental and social capital, while sustaining economic vitality.

Capital is comprised of resources invested to create new resources (Flora, 1998a). Sustainable capital, which can support the needs of present and future generations, consists of environmental capital and social capital. Environmental capital consists of natural resources such as air quality, water quality and quantity, biodiversity, landscape and ecological knowledge. Social capital refers to a relationship of mutual reciprocity and solidarity that inheres between individuals
and within groups that can facilitate their working harmoniously towards common goals.

Alternative agriculturists, as some recent studies show (Meares, 1997; Hassanein and Kloppenburg, 1995), constitute a growing community of interest, seeking a relationship with their environment (both social and ecological) that is built on mutuality and cooperation. They constitute a human capital resource that can insure actions that contribute to sustainability.

According to Lipson (1997), over 10,000 U.S. farms are now engaged in profitable, agronomically successful commercial production without reliance on synthetic fertilizers and pesticides. Doran, Fraser, Culik and Liebhardt (1987) and Altieri (1987) show that reduced reliance on external inputs (such as fertilizers and pesticides) can be important indicators of sustainability. While those indicators alone may not constitute sufficient evidence to conclude that such farms approximate sustainable agricultural systems, they nonetheless infer, to some degree, grassroots interests in alternative forms of production oriented towards sustainable agriculture principles.

Farmers seeking to adopt or test alternative agricultural technologies and management strategies often find the conventional sources of agricultural knowledge inadequate to meet their knowledge requirements (Gasteyer and Kroma, 1997; Rosmann, 1994). Such farmers increasingly turn to their own personal experiences and grassroots networks or seek alternative agriculture information centers for guiding their practices (Hassanein and Kloppenburg, 1995; Albee and Rikoon, 1996; Thornley, 1990). According to a 1997 report from the Appropriate
Technology Transfer for Rural Areas (ATTRA), inquiries about alternative agricultural practices and technologies from the North Central region grew from 2000 in 1989 to more than 18000 in 1996 (ATTRA, 1997).

Farmers awarded the SARE Producer Grants may have over the years generated enormous amounts of local/experiential knowledge from their practices. Alternative agriculturists that have been "invisible" in the early eras of chemical revolutions and expansionism may be rich repositories of local ecological knowledge.

While there is potential in that knowledge base to meet the knowledge requirements of the less experienced innovator in sustainable agriculture, very little is understood or systematically documented about its dimensions. Given the growing recognition of the potential value of local knowledge in contributing to sustainable agriculture, it becomes increasingly necessary to delineate and interpret the dimensions of local agricultural knowledge in order to inform the best approaches for harnessing it. It is also necessary to identify and inventory the knowledge requirements of alternative agriculturists if that knowledge base is to adequately serve the knowledge interests of transitioning farmers.

In the last few decades, two alternative agriculture information centers have appeared in the landscape: the Alternative Farming Systems Information Center (AFSIC) located in Beltsville, Maryland and the Appropriate Technology Transfer for Rural Areas (ATTRA) based at the University of Arkansas, Fayetteville, Arkansas. Supported by federal funds, their main activities are directed at meeting the knowledge requirements of agriculturists, including those seeking to shift to
alternative systems of agricultural production. ATTRA is of special significance in this study because it is the only information clearinghouse that has a toll free telephone line to agricultural clients seeking information on alternative practices in the U.S. ATTRA is partly funded under a federal grant from the USDA Rural Business- Cooperative Service.

The knowledge-related activities of ATTRA suggest it not only plays an important role in supporting grassroots initiatives towards the adoption of alternative agriculture practices, but that it can also be viewed as a key institution mediating grassroots transitions to sustainable agriculture. Thus an inventory of the knowledge requirements of ATTRA clients can be a useful guide for informing research of direct relevance to the alternative farmer.

Scholars interested in food systems suggest that increasing food quality and food safety concerns related to large-scale production will raise new demands from consumers in the coming decades (Goldman and Clancy, 1986; 1991; Sapp, Harrod and Zhao, 1994; Batie, Forster and Hitzhusen, 1993). Given that possibility, it is conceivable that demand for alternative sources of agricultural information will increase as farmers transition to alternative management strategies to capture strategic market niches. Appropriate technology and knowledge flows that can enhance alternative farmers' competitive edge will be critical in that process.

As the need for new kinds of knowledge and technology increases in an era of changing food demands, the conventional social organization for the flow of agricultural knowledge is increasingly viewed as a less useful framework for mediating strategic technology flows. An important factor in this conventional
system of knowledge flows relates to its hierarchical structure and unilinear direction of flow. In this system, knowledge is created through a research process, guided by the norms of scientific practice and validated through processes of peer review at professional conferences and journal submissions. Figure 1 presents a conceptual model of that system of knowledge flows.

The knowledge created is compiled for dissemination through public and private extension sources to farmers, who then employ that conventional knowledge.
for agricultural production decisions. The important thing about this system is that it is only one way. Moreover, the system creates a myth in that it presents a notion of scientific knowledge as prior to and leading to technology development.

Indeed long before the institutionalization of science, ordinary people were involved in the creation of artifacts and technologies, and developing skills and techniques by which they mediated the natural world in which they were embedded (Levidow, 1988; James, 1982; Brokensha, et al., 1980). That process represents a particular way of creating, accumulating and organizing knowledge/practice that is different from scientific knowledge (Turnbull, 1997). Whereas scientific knowledge is derived from nomological deductive processes based on general assumptions about nature, the knowledge produced in that alternative context is local and derived mainly from practical experience. Neither the creation nor the flow of that knowledge is necessarily hierarchical or linear. What is perhaps most critical is that the knowledge created and shared in that social organizational context constitutes valid knowledge for its social actors because it serves the purpose for which it is created (Marglin, 1996).

The local practices and knowledge of SARE farmer-researchers reflect an approach and offer a guide to the reconstructive project that Kloppenburg (1991) so compellingly portrays. To illuminate and therefore extend understanding of that cognitive activity, which I view as a concrete expression of a social movement, I build on Eyerman and Jamison's (1991) conceptual model of "cognitive praxis". That model postulates that social movements define their identity around the knowledge interests that they articulate and consciously organize to develop and
share through what they refer to as a process of communicative interaction. By knowledge interests, I refer to the set of information, ideas and skills that social actors consciously identify as relevant in the promotion of their goals.

That communicative interactive process is what Eyerman and Jamison (1991) describe as "cognitive praxis", an arena of social action from which new knowledge originates and is constructed as ideological frames that can shape and motivate collective action. From that perspective, cognitive praxis is a dialectical process in which action, ideology, and locally embedded knowledge can mutually reinforce and reshape each other. In Chapter III, I present a conceptual and empirical framework adapted from this model to guide my analysis of the cognitive dimensions of SARE farmer-researchers' local practices.

Eyerman and Jamison (1991) identify three dimensions of that dialectical process: the technological, cosmological and organizational. Those dimensions are dynamically interwoven, but nonetheless empirically verifiable categories, which, together, constitute cognitive praxis. The cosmological dimension constitutes the underlying philosophical principles, values and world-views that shape the meanings actors consciously construct of their actions and their interpretations of events. The technological dimension refers to the alternative techniques, skills and knowledge created and brought to bear in movement actors' advocacy for change. The organizational dimension reflects an ambition to develop more democratic forms of knowledge production. Taken together, these dimensions emphasize social movement actors as creators of knowledge and as new organizational forms, undergirded by principles that are different from, but not necessarily excluding,
conventional knowledge. Eyerman and Jamison (1991) employed that model to explore and systematize the internal dimensions of environmental movements in Sweden, Denmark and the Netherlands.

Cognitive praxis is a useful conceptual and analytic framework for understanding what social actors, loosely connected by a web of shared interests, represent for the development of new knowledge. While the particular character of that new knowledge has been less thoroughly theorized by Eyerman and Jamison (1991), they implicitly recognize that knowledge must encompass the totality of "knowledge types" grounded in different cultural contexts. That focus on "knowledge types" posits an understanding of knowledge as pluralistic, situated and shaped by specific cultures.

Hassanein and Kloppenburg (1995) suggest that among analysts who employ social movement theory to analyze actions for broader social change, Wainwright (1994) has most compellingly articulated the critical connection between practical, experiential, and tacit knowledge and social movement mobilization.

Wainwright (1994:xii) draws attention to the role of practical, experience-based knowledge (a) as a foundation for resisting and confronting dominant societal structures and (b) as a basis for action. In her study of civic movements in parts of Eastern and Western Europe, Wainwright maintains that social movements embody a new understanding of knowledge. While not always coherent, that new understanding views experience and theory, feeling and intellect in a relationship of mutuality, one that occurs as a process rather than a fixed moment of verification.
and falsification (1994:7). The production of knowledge is thus a social process, which is distributed, valued, and appropriated in ways that can be transformed.

I find these complementary perspectives useful for interpreting SARE farmer-researchers' alternative knowledge production and the mediating organizational networks that facilitate the movement of that alternative agricultural knowledge from specific locales and contexts of creation to larger social arenas for validation and exchange. I adapt the empirical dimensions delineated in cognitive praxis to analyze the alternative knowledge practices of SARE research farmers in the North Central region, as documented in their reports submitted to the funding agency, the North Central USDA-SARE, located at the University of Nebraska, Lincoln.

In Chapter II, I present a review of the literature relevant to the treatment of knowledge production as a socially constructed process that can mobilize and sustain collective action for social change. In Chapter III, I present a comprehensive treatment of the sources of data, description of the data and the analytical strategies employed in the study. The analysis and interpretation are presented in Chapter IV. In Chapter V, I present a summary of the analysis, implications and conclusions drawn from the study.
CHAPTER II

REVIEW OF LITERATURE

Introduction

In recent years, the knowledge question\(^1\) has emerged as a key issue in sustainable agriculture. Its discourses have principally evolved around debunking the normative assumptions of scientific knowledge and creating the possibilities of alternative knowledge, which I define as knowledge not generally recognized under the rubric of scientific knowledge. Some scholars argue that alternative knowledge can lead to more ecologically and socially viable "agicultures", while sustaining the economic vitality of agricultural and rural communities (Dahlberg, 1986; Ehrenfeld, 1987; Kloppenburg, 1991; Flora, 1992).

Farmers who undertake and participate in local processes of knowledge creation constitute a grassroots expression of a social movement, critical of conventional agriculture, who seek to mobilize around their knowledge interests for change in the U.S. agricultural landscape (Hassanein and Kloppenburg, 1995). Both advocates of alternative agriculture and scholars who perceive farmers as creative, mobilizing

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\(^1\) By knowledge question, I refer to recent debates and discourses within the scholarly community that challenge the universality and objectivity of scientific knowledge about the physical and material world.
agents posit cognition as the central dynamic.

To situate a context for my study, I review theoretical and empirical discourses that have framed the knowledge question and related mobilization processes to date, with a focus on scientific agricultural knowledge as a particular case of science practice. I build on those theoretical perspectives to adapt a conceptual framework that melds the sociology of knowledge and social movement theories to guide the study.

**Types of Knowledge**

Knowledge can be understood as an expression of the collective experiences of entire societies, as well as particular groups, classes, or communities (McCarthy, 1996). This suggests that knowledge is both a collective process and a historical construct.

A theoretical framework expanding the space for exploring different types of knowledge and ways of creating knowledge is the new sociology of knowledge (Knorr-Cetina, 1981; Latour, 1987; Gieryn, 1995; Harding, 1986; Swidler and Arditi, 1994; McCarthy, 1996). The new sociology of knowledge reflects on the question of how different types of social organization and cultural contexts can lead to the creation of different types of knowledge. This view contrasts with the old sociology of knowledge. Credited to the German sociologist Karl Mannheim, the old sociology of knowledge dwells on the question of how the social location of individuals and groups shapes their knowledge (Swidler and Arditi, 1994).
Whereas the old sociology of knowledge focuses primarily on the formal system of ideas and the specialists who produce ideas, the new sociology of knowledge links and draws attention to the practical and every day knowledge of individuals and the consciousness that shapes the practices and production of different forms of knowledge. I find the former perspective limiting and inadequate to the extent that it ignores the role of culture in determining what counts as knowledge among different groups, communities and societies. Because the new sociology of knowledge links specific and broader cultural patterns to the understanding of different types of knowledge, it presents a useful context to understand how knowledge relevant to a particular cultural environment can shape action.

McCarthy (1996) argues that knowledge reflects the particular forms of social intercourse, patterns of communication, and social organization that facilitate its production over time. For Swidler and Arditi (1994) and Turnbull (1997), the production of knowledge is merely a set of local practices conditioned and shaped by the cultural environment within which it is embedded.

According to Watson-Verran and Turnbull (1995), different sets of ideas and ways of understanding the natural world have been produced by different cultures in different spatial locations. From that perspective, it can be seen that understanding the world in any circumstance can come from the practical knowledge of every day experiences grounded in local contexts, as well as from knowledge acquired through nomological deductive processes of reasoning and inquiry. This posits a view of
knowledge as pluralistic and specific to the cultural context in which it is created and shaped.

One of the main insights of critical theories of knowledge is recognition of the importance of many different types of knowledge (Raedeke and Rikoon, 1997; Marglin, 1990; Swidler and Arditi, 1994). Researchers who ground their work in that pluralistic framework suggest that knowledge can be subjectively based on an inquirer's perspective. Furthermore, such scholars argue that inquiry itself is an intellectual construction, often expedited under local conditions to facilitate the perception and interpretation of the real world (Colin, 1994; Dlott. Altieri and Masumoto, 1994; Altieri. 1988; Harding, 1986).

Overall, those scholars converge around the position that in order to understand a type of knowledge it is necessary to study the observable properties of that knowledge, its cognitive and value dimensions, its symbols and forms of speech, and how it is linked to specific institutions. Understanding how any type of knowledge is linked to particular strategies for action and opportunity is, for these scholars, fundamental to a reconstructive project (Wainwright, 1994; Kloppenburg, 1991). These theoretical positions lay the groundwork for my research on the knowledge-related practices of SARE farmer-researchers and for beginning to understand how inquiries of agricultural clients from the North Central region can reflect a need for a specific type of knowledge.

In the light of these theoretical debates on knowledge and its relationship to action and subsequent social change, it becomes critical to understand the particular
character of SARE farmer-researchers' knowledge, its form and content, and how it relates to the movement for sustainable agriculture in the U.S. Historically, two types of knowledge are reflected in the literature on how people come to understand the world around them and act on that understanding to promote change. The two types of knowledge constitute western scientific knowledge and what I refer to in the context of this study as alternative knowledge.

Scientific Knowledge

Scientific knowledge refers to the stock of ideas, techniques and skills created over time through systematic, non-random, rational, and objective processes of observation, which lead putatively to the accumulation of value-free knowledge about nature (Rouse, 1987; O'Hear, 1989; Longino, 1989). Because that knowledge is assumed to be value-free, it is also assumed that it can be applied across varieties of social locations within different spatial and temporal dimensions (O'Hear, 1989; Merton, 1957; Kuhn, 1962; Pretty, 1994).

Scientific knowledge is grounded in positivist philosophy, a system of thought that developed in the enlightenment period of the 18th century. Credited primarily to the philosopher Rene Descartes, positivist philosophy posits that an objective reality, driven by immutable laws of nature, exists. The true nature of this objective reality, according to positivist philosophy, can be discovered and predicted by science, a mode of knowing that aspires to formulate laws or generalizations that describe regular conjunctions of events or phenomena (Wainwright, 1994; Pretty, 1994).
Scientifically established facts, then, are taken to be units of knowledge that describe phenomena and make the world more understandable (MacRae, et al., 1989). A particular feature of scientific knowledge creation is reductionism, that is, the tradition of dividing phenomena into discrete and manageable pieces for the purpose of inquiry. That orientation is reflected in the research activities of the community of professional scientists since the turn of the century (Busch, 1984; Pretty, 1994). Paralleling that reductionist orientation is the belief in the universality of the applications of scientific facts and its associated concept of inductive generalization. Latour (1986) characterizes such scientific facts as “immutable mobiles”, information that remains invariant through changing social and spatial locations (1986:714).

Added to the reductionist and universalistic orientation of scientific knowledge is its overwhelming emphasis on quantification. For scholars grounded in this tradition, quantification constitutes the critical condition under which rational evaluation of information and accurate descriptions of reality is made (MacRae, et al., 1989). The claim, thus, is that the production of objective knowledge (scientific knowledge) is made possible by the use of that inductive empirical logical structure.

While there was an almost universal tendency in the late 19th century to assert the primacy of scientific knowledge as the ultimate key to truth, the latter part of the 20th century has witnessed an orientation toward a more critical scrutiny of its role in society. As a consequence, scientific knowledge increasingly has become the subject of much contention and criticism among some scholars (Mulkay, 1979; Knorr-Cetina, 1981; Latour, 1987; Restivo, 1988; Seidman, 1996; Keller, 1982; Harding, 1986).
Such scholars suggest that the claims to objectivity and universality that bolster the pursuit of scientific knowledge are untenable in the face of widespread negative social, environmental and economic consequences of its applications in society (Busch and Lacy, 1983; Altieri, 1987). Other scholars suggest that those claims constitute a boundary-making process which professionals in the scientific knowledge disciplines have employed as a means of protecting the privileged status that they enjoy as creators of scientific knowledge (Wilensky, 1964; Abbott, 1988; Larson, 1977; Gieryn, 1983).

Boundary-making is defined as a conscious and purposeful process of attributing selected characteristics to the institution of scientific knowledge, which includes its practitioners, methods, stocks of knowledge, values and work organizations, for the purposes of constructing a social boundary that distinguishes some intellectual activity as non-science (Gieryn, 1983: 782). In essence, boundary work constitutes a conscious process, driven by self interests, of excluding some types of activities and individuals from a cultural space that confers upon those within that cultural space a kind of power that is not generally enjoyed by those outside it.

Kerr, Cunningham-Barley, and Amos (1997) illustrate that dynamic in a compelling case study of new genetics professionals and their accounts of the social context of their work. These scholars show how the notions that professionals are the "experts" and the public (and politicians) is ignorant about genetics are utilized as a rhetorical strategy that allows professionals to portray themselves as separate from and superior to society. At the same time that "bad science" is dismissed, objective advice relating to the social implications of the new genetics is advanced, rendering the
scientists' discursive boundaries permeable and flexible enough to protect their
cognitive authority.

Constructivists posit that no objective reality exists independent of the social
location and cultural experiences of the individual for whom that reality exists. In other
words, reality is socially constructed. Accordingly, constructivists premise their
arguments on the idea that the creation of scientific knowledge is merely a particular
cultural space within a larger cultural territory that some people have used to make
sense of the world around them (McCarthy, 1996). As Keller (1992) puts it, science is
merely one of those cultural spaces employed in the search for truth. But it is neither
the only way, nor the only cultural space. Other cultures also engage in making sense
of the material world around them, predict cause and effect, and develop techniques and
knowledge to make artifacts.

The Social Context of Scientific Knowledge Creation

Some scholars focus specifically on the social context of scientific knowledge
creation, perceiving it as an important site for analysis. They base their arguments on
the premise that the creation of scientific knowledge is, in essence, social practice and,
as such, constitutes an arena where the making of "scientific facts" is often based on
social decisions as opposed to technological decisions. Latour (1987) and Knorr (1981)
show the ad-hoc, local, linguistically and politically mediated character of scientists'
laboratory experiments through their ethnographic case studies of science laboratories.
Gieryn (1995) argues that by focusing their attention on professionals' "work sites",

these scholars succeed in exposing the "socially constructed" nature of scientific knowledge. Subsequently, scholars questioning scientific knowledge's objective stance find it increasingly appropriate to perceive it as a particular social construction in the light of results of their ethnographic and historical studies of scientific practices (Latour, 1987; Mulkay, 1979; Knorr, 1981). Social constructivists' interpretation of knowledge creation as a socially constructed process within specific social and cultural contexts provide a useful theoretical basis for my research into the social contexts of the knowledge-related practices of SARE farmer-researchers and agricultural clients in the North Central region.

Feminists' Critiques of Scientific Knowledge

Feminist scholars have been at the forefront of the critique of the adequacy of scientific knowledge for a socially just and ecologically healthy society. While I do not directly explore gender as a variable in knowledge creation and dissemination, I find feminists' theoretical focus on social location relevant to an understanding of SARE farmer-researchers' local practices. Social location, according to Meares (1997), refers to an individual's place in the constellation of social characteristics of gender, class, age, race/ethnicity and culture (1997:7). The knowledge-related activities of those farmer-researchers, I argue, suggest a certain degree of rejection, if not a total rejection, of the dominant agriculture knowledge. Therefore they can be viewed as occupying a social location different than the location of other farmers who are directly connected to and depend on the dominant scientific agriculture knowledge. I see their social location
as a key determinant of the personal and practical experiences shaping the knowledge they create. Therefore a brief review of theoretical debates on social location can provide important support for approaching SARE farmer-researchers as situated actors in a specific social location.

Feminist critics of scientific knowledge broadly fall within two conceptual camps, feminist empiricism and feminist standpoints (Harding, 1992). Arguments couchèd within the former generally support the goal for all scientific inquiry of value neutral objectivity and impartiality, but challenge the veracity of generalizations based only on data about men (Harding, 1992). In other words, their attacks are on bad science and not on science per se. Feminist standpoint arguments generally subscribe to the position that knowledge is grounded in experiences that are historically contingent and occur in specific social relations (Kabeer, 1994; Smith, 1987). Harding (1992) argues that in a society where power is hierarchically organized by class, race and gender, no perspective can be value neutral or detached from the particular historical social relation in which everyone participates. Instead, any individual or group can only achieve a partial view of reality based on where they are positioned in the hierarchy of social relations.

While they may diverge in their philosophical treatment of the society/scientific knowledge nexus, feminist scholars universally converge in their recognition of the distortions introduced into the construction of scientific knowledge by the historical legacy of androcentric bias. Keller (1982), Smith (1987), and Harding (1986; 1992) challenge what they refer to as the objectivist illusion of modern scientific inquiry.
Indeed contrary to the tenets of rational scientific inquiry, these feminist scholars perceive inquiry as a dialectical relationship between the inquirer and the inquired. They also perceive the inquiry process as a form of communication that is not an end in itself but a process that reveals new ways to deal with new situations, or lead to new paths of discourse (Helke, 1989; Harding, 1992; Keller, 1982). If SARE farmer-researchers and ATTRA clients in the North Central region are creating new knowledge, then they are likely charting or expanding a new course for promoting a grassroots movement for social change in U.S. agriculture.

Relationship between Scientific Knowledge and Technology

Scientific knowledge, some scholars suggest, is a direct product of capitalism, instrumentally devised to serve its needs (Restivo, 1988; Levins and Lewontin, 1995; Busch, 1984). To those scholars, scientific knowledge constitutes the instrument by which capitalist production is transformed or made more efficient to facilitate surplus (Levins and Lewontin, 1985). The idea of scientific knowledge as instrument connotes a notion of knowledge as constitutive of technology. That conceptual separation of knowledge and technology is very important and requires some reflection, because of its implication for my study of the local practices of the SARE farmer-researchers. Specifically, the separation of knowledge and technology projects a basis for inquiry into whether SARE farmer-researchers' knowledge-related activities merely constitute a set of local practices organized around the creation of “what works” in a particular circumstance and locale, rather than a conscious knowledge creation activity.
The advent of the modern institution of scientific knowledge and the cognitive authority it enjoys lead to an implicit or taken for granted notion of technology as a logical product of science (Keller, 1992; Levidow, 1988). While scientific technology is seen as a product of western scientific knowledge, technology is ontologically prior to western science. According to Smith Keller (1992), technology is as old as human beings and is primarily about coping with immediate practical needs, such as food. shelter, health and communication. “Tekne”, a dimension of technology means art (in the sense of a way of doing), while “logike”, means reasoning. Technology therefore is reasoning about the art of doing (1992:24). That definition of technology, which thus predates science, makes use of practical rules of thumb, develops with experience, is specific and cannot be easily generalized.

The relationship between scientific knowledge and technology is a dialectic in that scientific innovation, which is the product of science, can in turn shape and contribute to the store of existing knowledge (Bell, 1995). Scientific knowledge, thus, is more than technology. While technology itself can be the partial embodiment of science, science transcends its practical applicability in concrete temporal and spatial instances to expand the store of existing knowledge. Thus scientific knowledge enjoys almost universal cognitive authority as the dominant system of knowledge production (Turnbull, 1997; Gieryn, 1995; Lemons and Brown, 1995; Pretty, 1994). That cognitive authority undergirds its success in permeating practically all aspects of western discourse although studies show that historically other types of knowledge,
which I refer to in the context of this study as alternative knowledge, have existed in U.S agriculture and other parts of the world.

Alternative Knowledge

I use the term alternative knowledge to refer to other types of knowledge that differ from the dominant scientific knowledge in their methodological and epistemological structures. Alternative knowledge can be defined as the ideas, skills, techniques and insights accumulated through practice and experience of actors situated in specific local and cultural contexts. Depending on the particular historical, cultural and socio-political context, alternative knowledge can be described as practical knowledge (Wainwright, 1994), personal knowledge (Polanyi, 1958), local knowledge (Geertz, 1983) and indigenous knowledge (Brokensha, Warren and Werner, 1980; McCorkle, 1994; Richards, 1980; Pretty, 1994).

According to Levidow (1988) and Pretty (1991), these other kinds of knowledge developed prior to the development of scientific knowledge. Though shaped by the unique cultural circumstances of their specific locations, alternative knowledge is systematic and innovative. Watson-Verran and Turnbull's (1995) research on four social groups situated in different parts of the world provide further theoretical support to my analysis of situated actors' local practices. The scholars analyzed four social groups: the Gothic cathedral builders in France at the turn of the 11th century, the Anasazi Indians, the Incas and the Micronesian Pacific navigators.
Their research traces the processes by which successive and different teams of masons used their accumulated store of experiences, skills and local geometries to construct a complex Gothic structure, the Chartres, that now feature among the major architectural wonders of contemporary western society. Their study also illustrates the sophistication of the local skills of astronomy, which enabled the ancient Anasazi Indians in North America to produce and even accumulate surplus in an extremely arid and hostile geographic environment for hundreds of years.

The knowledge undergirding those accomplishments is different than scientific knowledge, in that it is concretely embedded in practice and expressed through the skills and ingenuity of its members in developing material artifacts and social technologies that allowed the development of complex systems of knowledge creation and transmission.

These examples of local accomplishments, built on the collective and accumulated experiences of situated actors, challenge the claims of superiority to other types of knowledge that scientific knowledge enjoys. Rather than embarking on a comparison of the superiority of one type of knowledge over another, the approach taken by these scholars stresses the importance of treating knowing as an experiential and situated (local) activity. Such knowing, as Hobart (1993:17) emphasizes, requires evaluation by some measure, such as its appropriateness to particular circumstances and unique locales. With regard to SARE farmer-researchers, it is possible that what becomes important is "what works" in the context of their particular agricultural
environment and within the framework of the personal values that they may hold regarding their agricultural practices.

Both western scientific knowledge and alternative knowledge are intrinsically related to agricultural production systems in the U.S. Western scientific knowledge, in particular, is pivotal in the social shaping of the dominant system of agricultural knowledge.

**Types of Agricultural Knowledge**

Agricultural knowledge appears to defy a specific definition because of the range of connotations it can have in different cultural contexts (Raedeke and Rikoon, 1997). Broadly defined, it refers to the range of agricultural production skills, techniques and ideas that accumulate through systematic, non-random processes of observation, as well as through the personal experiences of situated actors across different cultural and local contexts. In general, two types of agricultural knowledge are pivotal in the social shaping and historical transformation of agricultural production in the U.S: scientific agricultural knowledge and alternative agricultural knowledge.

**Scientific Agricultural Knowledge**

In the western world, the creation of agricultural knowledge became a subject of the scientific enterprise in the early part of the 19th century, culminating in what is now described as scientific agriculture knowledge (Danbom, 1986; Dahlberg, 1986; Levins and Lewontin, 1985). Scientific agricultural knowledge can be broadly defined as the
range of agricultural information, ideas, skills and techniques accumulated through methods of experimental design that are guided by the positivist principles of scientific research.

According to Rossiter (1975), the institution of science had very little to do with farming in early 19th century farming (Lewontin and Berlan, 1986). The beginnings of organized scientific agricultural research in the United States, as Rossiter suggests, stemmed from the work of Justus Liebig, a German scholar, whose research in agricultural chemistry in the 1840s had a profound impact on scholars and farmers alike. Danbom (1986) notes that scientific agriculture did not exist in the United States until about 1850, when the first agricultural professional science immigrants trained in Germany arrived (1986:109).

The view that agriculture should be based on science drew increasing support among some sections of the farming community and professional scientists (Rossiter, 1975; Danbom, 1986). The success of American agriculture was directly linked to the adoption of scientific principles and the acquisition of scientific agricultural knowledge based on the core scientific tenets of objectivism, experimentation and logical deductive reasoning (Marcus, 1985; Rosenberg, 1976; Carstensen, 1960).

The creation of the USDA in 1862 ushered in the beginning of an enduring and fruitful program of support for agricultural science (Hadwiger, 1982). According to Marcus (1985) the Hatch Act, passed in 1887, not only authorized the establishment of the agricultural experiment stations but also signified the legitimatization of scientific agricultural knowledge in the U.S. The establishment of the agricultural experiment
stations opened an important avenue for channeling both federal and state funds into professionalizing the agricultural research process at the local level (Hadwiger, 1982; Huffman, 1986).

One source of support for scientific agricultural knowledge came from the farming community itself, albeit the more wealthy farmers, who were quick to perceive that their alignment with the state in the interest of science would also serve their individualistic goals (Busch and Lacy, 1983). Discerning that they could reap short term economic benefits while passing on the long term costs of innovation to the state, these farmers became, in the words of Busch, “one of the most vocal advocates for formal agricultural research” (1983:6).

While scientific agricultural knowledge generally found support among some farmers, other farm organizations like the Grange, the Farmers Alliance and the Populist Party actively resisted the development of formal institutions for creating that knowledge (Danbom, 1986; Marcus 1988). In the end, the advocates for scientific agriculture won. So began a process whereby knowledge generated through farmers’ experience in the management of agricultural land was gradually delegitimized and replaced by scientific agricultural knowledge (Marcus, 1985; 1988). The study of SARE farmer-researchers' local practices will potentially provide an example of how the process of knowledge creation through farmers’ experience can be a legitimate contribution to agricultural change.

Scientific agricultural knowledge created in public institutions for research and education enjoys a pre-eminent position as the engine of agricultural production
technologies in the U.S. and other countries in the western world (Cochrane, 1979; Buttel and Busch, 1988; Busch and Lacy, 1983). Indeed, the principal actors in this high input, industrialized system of agriculture attribute the relatively low cost and abundance of food and fiber to the superiority of that scientific agricultural knowledge and technology (Duvick, 1988, Borlaug, 1992; Drache, 1996). As Fisher and Zuiches (1994) put it, "[O]ver the past 107 years, the publicly supported agricultural research system has generated the technology and knowledge to ensure a moderately priced and stable supply of nutritious food and quality fiber for a rapidly developing nation" (1994:2).

In recent years, some scholars have begun to pay greater attention to scientific agricultural knowledge and the consequences of its products on society and the physical environment (Kloppenburg, 1991; Ehrenfeld, 1987; Lewontin and Berlan, 1986).

Scientific agricultural knowledge has led to consequences detrimental to the material and social environment, although rural environments are usually the most vulnerable areas (Kloppenburg, 1991; Ehrenfeld, 1987; Buttel, 1992; MacRae, 1989). Chemical technologies developed through the application of scientific research are regularly implicated in the degradation of natural resources, including soil, air, and water (Lighthall and Roberts, 1988; Padgitt and Lasley, 1993; Napier and Brown, 1993). Some epidemiological studies posit either direct or indirect causal relationships between specific agricultural chemicals and certain types of human illnesses (Blair and White, 1985; Burmeister et al., 1983).
Scientific agricultural knowledge also has a critical social justice component. Hurt (1991) suggests that the development of the mechanical tomato harvester at the University of California, and cotton harvesters by agricultural researchers at Purdue, Michigan State, and the Ohio State University devastated farm laborers in regions where those crops predominated. Allen and Sachs (1993) observe that agricultural workers in the conventional agriculture systems experience the worst living and working conditions in the U.S. and face high incidence of health problems associated with pesticide use.

Scientific agricultural knowledge reflects a reductionist orientation (grounded in positivist philosophy) that accounts for much of the current environmental and agricultural problems faced in western agricultural systems (Busch and Lacy, 1983; Ehrenfeld, 1987; Miller, 1982; Suppe, 1987; MacRae et al., 1989; Madden, 1986). By sharing that reductionist approach, agricultural scientists tend to externalize negative impacts of their agricultural pursuits on the physical and human environment.

The positivist orientation fueled the struggle of early agricultural professionals aspiring to emulate the model of the natural sciences, because it was deemed the superior approach to understanding the natural world (Carstensen, 1960; Dundon, 1986; Danbum, 1990; Wainwright, 1994). Indeed, these scholars suggest that agricultural professionals felt inferior because of the real world orientation of their work and therefore derived some measure of scientific legitimacy through the random block designs employed in field trials, emulating the experimental method. Because agricultural scientists historically emphasized applied as opposed to theoretical
research, they were perceived as second class citizens in the scientific community. Danbum (1990), citing Porter, (1979), recounts how the Carnegie Institute in 1908 actually excluded land grant colleges from its retirement plans because they were not perceived to be really collegiate level institutions.

According to Suppe (1987), governmental agricultural research of the sort done by research stations and disseminated by cooperative extension has proven to be inapplicable to the actual practice of farming as a result of that reductionist orientation. Suppe (1987) contends that the assumption of random selection and control of extraneous variables in the experimental research context is fallacious, because field plots and animal samples are never randomly selected from the relevant farm populations.

Suppe sees an agricultural system as an aggregation of sub-optimally performing systems that, by its very nature, the reductionist method intrinsically denies. Given that plurality of sub-optimally performing systems, it is impossible to obtain an absolutely representative sample in any agricultural population, or even control all possible extraneous variables in the environment at any given time. Thus the applicability of scientific agricultural research under real world farming situations can be viewed to be rather limited. The local practices and inquiries of SARE farmer-researchers in the North Central region present an ideal opportunity to extend understanding of the social and technical character of knowledge produced through personal farmer participation under real world farming conditions.
Some scholars view scientific agriculture knowledge as a tool for the penetration of capital into agricultural production (Levins, and Lewontin, 1985; Restivo, 1988; Berlan and Lewontin, 1986). The notion of agricultural knowledge as tool connotes knowledge as constitutive of technology and ideas. Indeed, as Warner and England (1995) put it, any type of scientific knowledge constitute the “knowing what” (or "how to") and the “knowing why.” Technology is the “knowing how to”. which embodies both material and social artifacts (particular kinds of knowledge about how to produce desired and intended outcomes). In this sense, scientific technology constitutes the empowered element of science -- that which specific interests instrumentally utilize in achieving desired outcomes and goals. The "knowing why" constitutes accumulated ideas and information that when internalized, become a critical component of knowledge.

Fitzgerald (1993) suggests that before the development of hybrid corn around 1908 by geneticists Harrison Schull and E.M. East at the Connecticut Experiment Station in New Haven, it was common practice for local farmers to participate in seed selection for subsequent cropping seasons. Being very attentive to the ecology and local specificity of their physical environment (such as soil type, composition, rainfall pattern, etc.), farmers developed a phenomenal ability to identify physical distinguishing characteristics among different corn varieties. As she put it, “they learnt to read ‘corn’ and translate those characteristics into locally meaningful indicators of yield quality, insect resistance or simple aesthetic value” (1993:329).
The local practices of those early farmers, I suggest, constitute the knowing "how to" of corn production. Indeed, over time, that "how to" becomes dialectically related to the "knowing why" as experience unfolds and contributes to the store of the broader knowledge base for corn production. Theoretically, this lays an important groundwork for approaching an understanding of SARE farmer-researchers. It relates to whether their knowledge-related practices reflect the "how to" of knowledge or the "knowing why." I hypothesize that the local practices of SARE farmer-researchers, rather than being either of these components, constitute instead, a dialectic.

The charge that scientific agriculture knowledge constitutes a tool in service to capitalist interests underpins Fitzgerald's (1993) analysis of the development of hybrid corn in the U.S. She shows how the replacement of open-pollinated seed corn with hybrid corn transformed an indigenous process of seed selection into a commodity system that excluded farmers as "experimenters" in their own right to mere consumers of technology. Controlled hybrids eventually replaced open pollinated corn in the U.S. Whereas, according to Fitzgerald, hybrid corn accounted for 0.4 percent of total corn acreage in 1933, by 1945, it accounted for 90 percent.

Interestingly, successful hybrid corn breeders, like Henry A. Wallace, justified the delegitimization of farmers by pointing to the "irrational" logic of their selection criteria. He argues that because farmers' selection criteria focused primarily on the selection of "show corn" (that is, physical appearance), their selection strategies did not translate into increased yields (Berlan and Lewontin, 1986). In other words, farmers
based their selection on the wrong set of criteria, which were artificially developed by
the competition of the country fair, not the marketplace.

In contrast, Fitzgerald (1993) presents a more persuasive explanation. She
argues for the possibility (given breeders' implicit interests in appropriating control of
the breeding process) that arguments and justifications such as Wallaces' may have
been merely a "boundary-making" process designed to delegitimize farmers' selection
criteria, while protecting the cognitive authority of "scientific breeding".

Given the universal success seed companies had in that replacement process, it
can be argued that farmers' sophisticated knowledge of selection through visual
characteristics and judgement based on their particular local and ecological conditions
may now be almost, if not entirely, lost. Because commercial hybrids decrease in yield,
Berlan and Lewontin (1986) argue that it became necessary for farmers to renew their
seeds every year, thereby creating a perpetual market for hybrid seed.

These arguments build a case for careful examination of the cognitive activities
of SARE farmer-researchers and other alternative agriculturists in the North Central
region. If analysis of their reports and inquiries infer that they participate in innovative
processes related to the regeneration and revival of experiential knowledge, the insights
can have very important implications for promoting grassroots sustainable agriculture.

**Alternative Agriculture Knowledge**

Just as with alternative knowledge, to which it is related, there appears to be no
concise definition for alternative agriculture knowledge. This is because of the
diversity of practices included under its rubric and the connotations it can have under different social and cultural contexts.

Some scholars define alternative agricultural knowledge in terms of its spatial specificity and temporal characteristics (Kloppenburg, 1991; Feldman and Welsh, 1995; Banuri and Marglin, 1993). Others pay attention to its local and indigenous nature (Turnbull, 1997; Richards, 1993; Pretty, 1994). In this study, I define alternative agricultural knowledge as the techniques, knowledge and skills that farmers accumulate through their personal experiences and either consciously or unconsciously employ in the process of managing their natural resources for production.

Long before the development of scientific knowledge, people who tilled the land produced knowledge based on their personal experience in the management of their crops and livestock (Marcus, 1985; 1988; Pretty 1991). That store of agricultural knowledge became the guidepost for subsequent production and management decisions in the agrarian systems of the era (Rodale, 1983).

According to Pretty (1991), 17th and 18th century farmers in Britain increased crop and livestock production two to four-fold by sharing new knowledge they gained through systematic observation and personal experimentation on their farms. There are a diversity of ways that farmers perceive, evaluate and incorporate agricultural knowledge into their decision making (Radaeke and Rikoon, 1997; Hassanein and Kloppenburg, 1995; Francis, et al., 1990). How farmers incorporate diverse types of agricultural knowledge is nuanced by the cultural contexts in which they are embedded, and concretely shaped by the values, norms and ideologies that define those contexts.
In non-western cultures, an extant system of classification and cognition exists through which large bodies of empirical knowledge based on local experience and practice can be accumulated and applied in agricultural production (Brokensha et al., 1980; Richards, 1993; McCorkle, 1994; Pretty, 1994). That is not different in western cultures where that particular mode of cognition is largely subsumed under the dominant scientific agricultural knowledge and moved to the margins of mainstream agricultural discourse.

According to Long and Long (1992) and Raedeke and Rikoon (1997), sustainable agriculture activists, particularly those in the professional and academic institutions, focus more on orienting scientific agricultural knowledge, rather than articulating new visions of alternative knowledge. A major limitation in such an approach, according to such scholars, is that it typically entails a mere "tinkering around the edges," employing incremental and piecemeal approaches rather than creating an alternative space for negotiation of what ought to count as knowledge in the context of sustainable agriculture.

Feminist scholars interested in agricultural relations argue that personal experience and place are salient in any discussion about agricultural knowledge. Feldman and Welsh (1995), for example, examine the local context of agricultural production as a complex, heterogeneous, and contested terrain and argue for the specificity of agricultural practice. In other words, knowledge that may uniquely fit a particular context can be completely irrelevant in another geographical and cultural context. They suggest that it is only through focus on the local and the specific that the
diversity of experiences and multiple identities that shape knowledge in any cultural context can be clearly illuminated. By drawing attention to the diversity of agricultural knowledge, Feldman and Welsh elevate the salience of social location, including gender, to a level of importance that has traditionally not been accorded to "difference" in the discourse on agriculture in the industrialized world.

Kloppenburgh (1991) builds on feminist theoretical perspectives on situated knowledge and personal standpoint to argue that scientific agricultural knowledge can be seen as partial, providing neither an adequate nor a complete account of the sphere of agricultural production. He suggests that because that partial knowledge has been unquestionably accepted as the only way of knowing, the possibility of alternative visions and alternative ways of knowing continue to be rejected in the mainstream of scientific discourse.

To farmers who are embedded in their local context of production, the implicit denial of their agency as meaning constructing actors constitute a focal point of criticism in Kloppenburg's work. Kloppenburg (1991) points out that before the establishment of the land grant complex of scientific agriculture in the latter part of the 19th century, farmers were the chief developers and purveyors of new agricultural practices and technologies. Kloppenburg (1991) argues that "science experts" in the land grant system perceived the continuing participation of farmers in agricultural inquiry as a threat to their intellectual status and as a result deployed strategies that eventually culminated in the delegitimation of farmers as active participants in their own right. Indeed farmers' concomitant reappearance as passive recipients of
technology serves as the most concrete attestation to the success of that delegitimation project (Flora, 1992; Lacy, 1996).

The delegitimation project also signifies the erosion of context. Scholars who argue for the sustainability of local agriculture insist that locality is central to the production of a unified field of knowledge attuned to the concrete exigencies of local conditions (Feldman and Welsh, 1995; Flora, 1992; Ehrenfeld, 1987; Gladwin, 1989). Flora (1992), for example, argues that, contrary to the conventional wisdom held among scientific agriculture adherents, farmers who are engaged in alternative local systems of production not only sustain production levels and maintain net returns, but also gain important knowledge, based on their experimentation and use of alternative management practices. These debates provide strong theoretical support to examine whether or not, as farmers participate in local level agricultural inquiry on their farms, they are consciously aware that their activities concretely contribute to the creation of alternative agriculture knowledge and promotion of the grassroots movement for sustainable agriculture.

In the U.S. agricultural landscape, the move towards alternative agriculture knowledge can be labeled a paradigm shift (DeWalt, 1994). Beus and Dunlap (1990) lay out two agricultural paradigms, the dominant/conventional agriculture paradigm and the alternative agriculture paradigm, and suggest that the two are intrinsically linked to different modes of knowledge creation and dissemination. Whereas scientific agricultural knowledge is based on a set of values that are reflected in the conventional agricultural paradigm, alternative agriculture knowledge is intrinsically linked to the
alternative agricultural paradigm in that both are grounded in a similar set of values.

Extending the research by Beus and Dunlap (1990), DeWalt (1994) develops a model that characterizes the different values underlying conventional scientific knowledge and alternative knowledge. In his model, DeWalt highlights both the characteristics of the knowledge types and a comparison of the key elements embodied. That model is presented in Table 2.1.

Table 2.1: Key Characteristics of Conventional and Alternative Agricultural Knowledge

<table>
<thead>
<tr>
<th>Conventional Agricultural Knowledge</th>
<th>Alternative Agricultural Knowledge</th>
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<tbody>
<tr>
<td><strong>Means used to study phenomena</strong></td>
<td></td>
</tr>
<tr>
<td>• Specialized, partial</td>
<td>• General, holistic</td>
</tr>
<tr>
<td>• Based on experimentation</td>
<td>• Based on observation</td>
</tr>
<tr>
<td>• Immutable mobiles</td>
<td>• Mutable immobiles</td>
</tr>
<tr>
<td><strong>Resource utilization characteristics</strong></td>
<td></td>
</tr>
<tr>
<td>• Dependent on external resources</td>
<td>• Dependent on local resources</td>
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<tr>
<td>• High input</td>
<td>• Low Input</td>
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<tr>
<td>• Land Intensive</td>
<td>• Land extensive</td>
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<tr>
<td>• Labor saving</td>
<td>• Labor demanding</td>
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<tr>
<td>• Market risk</td>
<td>• Environmental risk</td>
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<tr>
<td>• Specialized adaptive strategies</td>
<td>• Diverse adaptive strategies</td>
</tr>
<tr>
<td><strong>Outputs</strong></td>
<td></td>
</tr>
<tr>
<td>• Low productivity for energy</td>
<td>• Low productivity for labor inputs</td>
</tr>
<tr>
<td>• Cultural dysjunctions</td>
<td>• Culturally compatible</td>
</tr>
<tr>
<td>• Profit goals</td>
<td>• Subsistence goals</td>
</tr>
<tr>
<td>• High Potential for degradation</td>
<td>• Low potential for degradation</td>
</tr>
</tbody>
</table>

Adapted from DeWalt, 1994.
The DeWalt model highlights key distinctions between scientific agriculture knowledge and alternative agriculture knowledge. However, some of the elements identified do not have salience in the context of U.S. agriculture knowledge. For example, subsistence production, which DeWalt identifies as a characteristic of alternative agriculture knowledge, carries little meaning in a capitalist agricultural economy where farmers, irrespective of farm scale or size, are clearly linked to markets and regularly exchange agricultural products for money.

The conceptual positioning of the two types of agricultural knowledge as mutually exclusive categories become extremely problematic in that it fails to recognize the potentially dynamic and dialectical nature of knowledge in particular cultural and social circumstances (Turnbull, 1997). Raedeke and Rikoon's (1997) study is one of the few empirically based studies in the context of the U.S. that explicitly focuses on agricultural knowledge systems as overlapping, rather than as mutually exclusive dimensions.

They identify two types of farmers that they categorize as specific knowledge communities. They refer to the two knowledge communities as reflecting two processes by which knowledge is constructed. They identify one knowledge community as LES (local experiential subjective) and the other as LEO (local experimental objective). They conclude, based on their analysis, that rather than grounding their management decisions solely on the type of knowledge that typifies their community, farmers in each community selectively meld different aspects of knowledge from both communities to arrive at decisions regarding their farm level
management. Their work provides strong theoretical support for my study. First, their study specifies key elements that can shape an understanding of the local practices of situated actors, such as SARE farmer-researchers. Second, their study illuminates the potentially overlapping nature of the dimensions of knowledge that may be reflected in agricultural information and knowledge related practices of farmers in the North Central region.

The theoretical debates so far underscore the importance of investigating the content and character of alternative knowledge embodied in experience and observation, and how that knowledge can have critical implications for social change. SARE farmer-researchers and agricultural information seekers in the North Central region can be creators of knowledge and also actors in the movement for sustainable agriculture. However, none of the theoretical debates thus far link cognition and knowledge creation as ideology that can motivate and drive collective action. Buechler (1993) defines an ideology as the constellation of ideas, beliefs, values and symbolic meanings that can motivate and impel collective mobilization and action.

**Knowledge and Social Movements**

Broadly defined, social movements constitute collective action or mobilization by a plurality of actors who share a common concern with an existing social, political or cultural order perceived to be antithetical to their interests and welfare. Farmers' movements are not novel phenomena in the U.S. agrarian landscape. Agrarian social movements date as far back as the Colonial period (Mooney and Majka, 1995) and
move from economic organization against an intrusive state to economic organization against monopoly capital (Flora, 1996; Egan, 1996). In the seventies, the American Agriculture Movement organized to achieve federal support for parity prices (Browne and Lundgren, 1987), and in the 1980s the farm debt crisis led to political mobilization of farmers against farm foreclosures (Meyer and Lobao, 1996). In none of these social movements, however, was knowledge or issues of cognition a shared or ideologically framed concern.

**Alternative Agricultural Knowledge, Collective Action and Social Movements**

In recent decades, scholarly interests in the loose networks of farmers who have transitioned or are transitioning from conventional agricultural practices to alternative agricultural practices have accelerated. Such farmers have been shown to share an orientation to nature and agricultural production and a search for alternative knowledge that have come to symbolize a collective identity among scholars (Mooney, 1990; Buttel, 1992; Hassanein and Kloppenburg, 1995). That collective identity is a critical force in the emergence and mobilization of sustainable agriculture groups in the agricultural landscape in recent years. Many analysts now perceive such farmer networks and associations as constitutive of a social movement (Meares, 1997; Buttel, 1992; Mooney and Majka, 1995).

Although many theoretical debates on social movements focus attention on individuals' mobilization processes in order to understand the bases of their action (Rochon, 1998; Klandermans, 1992; Cohen, 1985; Melucci, 1989, McAdam, 1982),
few reflect on cognition and a desire for new knowledge as a potential catalyst for action. Among the few theorists who focus on knowledge as a critical determinant of movement mobilization, it is Eyerman and Jamison (1991) and Wainwright (1994) who most comprehensively articulate the relationship between knowledge, action, collective identity, and resources in individuals' mobilization against a perceived problematic order.

Eyerman and Jamison (1991) present a theoretical perspective that suggests that social movements represent more than just simple challenges to power. They direct attention to the cognitive activity of movement actors and the mediating role a social movement can play in the social shaping of knowledge. They link those elements in a conceptual framework they describe as "cognitive praxis". Eyerman and Jamison draw on two intellectual traditions, Habermas's concept of communicative action and socio-semiotics to develop an understanding of social movements. They define a social movement as

...a form of communicative interaction or cognitive praxis, a socially constructive force for the determination of human knowledge. Seen in symbolic terms, movements no longer operate as characters but as "signs" in the sense that they translate their action into symbolic challenges that upset dominant cultural codes by acting at the levels of information and communication (1991:48).

The cognitive praxis of social movements, in Eyerman and Jamison's conceptualization, becomes the social action from which new knowledge can develop.
While they do not specifically emphasize local knowledge, they identify meaning construction in situated contexts as knowledge pivotal to transformative social action. The categories explicated by Eyerman and Jamison provide a useful theoretical base from which to approach an understanding of knowledge as a critical dynamic in social action at the grassroots. In relation to SARE farmer-researchers, I assume their knowledge interests and related activities constitute a pivotal issue around which they organize and out of which their collective identity is formed.

Eyerman and Jamison (1991) identify three dimensions of cognitive praxis in their study of environmental movements in Scandinavia: cosmological, technological and organizational. They refer to the cosmological dimension as underlying assumptions, values and worldviews. The technological dimension relates to the alternative techniques, skills and knowledge created and brought to bear in movement actors' advocacy for change. The organizational dimension infers an ambition to deconstruct the putatively exclusive character of expertise and develop more democratic forms of knowledge creation. It refers to relationships and linkages with institutional agents who share similar values and invest resources, both intellectual and practical, towards successful mobilization at the grassroots. Taken together, these dimensions emphasize social movement actors as producers of both knowledge and new organizational forms.

Eyerman and Jamison (1991) emphasize the linkages between structural conditions and social forces that mediate individual ability to participate and the cognitive needs of individuals that can drive collective action. Agency and structure
are dialectically interconnected. By linking individual action and institutional resources together in a framework of social mobilization, Eyerman and Jamison (1991) bring into focus the dualism historically introduced into the conceptualization and definition of social movements.

Two main types of sociological interpretations of social movements have solidified over the years: social psychological and resource mobilization interpretations. Socio-psychological interpretations of collective behavior are grounded in the idea that individual personality traits and states of mind, such as alienation, marginality, grievances and ideology, provide the most plausible reasons for individual participation in collective action (Gamson, 1992; Cohen, 1985; Melucci, 1989).

In contrast, scholars who subscribe to the resource mobilization approach define social movements in terms of a rational and instrumental individual behavior (McAdam, 1982; McCarthy and Zald, 1977). The resource mobilization interpretation of social movements emphasizes the importance of social structural factors such as availability of resources to a group, and the positions of members in social networks. Within the resource mobilization perspective, the focus is not on the individual or his agentive potentials. Individual attitudes, preferences and values are seen as preexisting and stable, logically prior to, and unrelated to mobilization.

Social analysts sympathetic to the resource mobilization perspective thus view social movements as organizational agents that are skillful in the mobilization of social resources in the rational pursuit of some perceived reward. Resources are defined
broadly to include not only land, labor and capital, but also authority, social status and personal initiative (Eyerman and Jamison, 1991).

Because the two theoretical positions are generally offered as mutually exclusive independent explanations of collective mobilization, some scholars find both frameworks inadequate for explaining the complexity of factors that intersect in the process of mobilization (Ferree, and Miller, 1985; Gamson, 1992; Melucci, 1996). Such scholars direct attention to the importance of structural conditions as important factors in successful mobilization, even as they argue for the salience of subjective psychological factors.

Eyerman and Jamison's cognitive praxis transcends the impasse posed by both resource mobilization and socio-psychological explanations that appear to lock mobilizing processes in either a rational cost-benefit logic or some ideological state of mind. Cognitive praxis transcends that dualistic impasse by reflexively grounding its framework at the intersection of agency and structure, defining social actors as critical variables in social movements, while acknowledging the importance of structural contexts.

Wainwright (1994) provides additional theoretical support for my research. She most compellingly articulates that critical connection between practical, tacit knowledge and social movement mobilization. Unlike Eyerman and Jamison, she explicitly places mobilization at the intersection of personal practical knowledge and agency. Wainwright (1994:xii) draws attention to the role of practical, experience-
based knowledge (a) as a foundation for resisting and confronting dominant societal structures and (b) as a basis for action.

In her study of civic movements in parts of Eastern and Western Europe, Wainwright maintains that social movements embody a new understanding of knowledge. While not always coherent, that new understanding views experience and theory, feeling and intellect, in a relationship of mutuality, which occurs as a process rather than a fixed moment of verification and falsification (1994:7). She assumes the production of knowledge is a social process distributed, valued, and appropriated in ways that can be transformable. She focuses explicitly on the personal practical knowledge of situated actors in mobilizing action at the grassroots. Wainwright's theoretical insights expand the theoretical context in which I situate my study of farmer-researchers and agricultural clients in the North Central region.

Together, Eyerman and Jamison's (1991) cognitive praxis and Wainwright's practical knowledge can inform a conceptualization of alternative knowledge actors as creators of knowledge. Through these two lenses, it is possible to identify and characterize the range of new ideas and values that define the collective identity of SARE farmer-researchers and agricultural clients in the North Central region. The analytical dimensions, cosmological, technological and organizational, are conceptually useful in understanding sustainable agriculture knowledge dimensions and flow processes.

Accordingly, the knowledge systems perspective grounded in Eyerman and Jamison's model of "cognitive praxis" guides the conceptualization of my study. This
study specifies that framework to examine farmer knowledge creation and sharing as a dialectical process – the production of knowledge that shapes what "works" in the everyday production arena that in turn informs what is constructed by social actors as meaningful knowledge. The questions for research therefore are

1. What are the cognitive and value dimensions of the knowledge-related inquiries made by farmers in the North Central Region?

2. How do those inquiries relate to the research undertaken by farmer-researchers in the North Central region?

3. What are the cognitive and value dimensions of the practices of SARE farmer-researchers in the North Central region, as reflected in their reports, and how does that cognitive process relate to social change in agriculture at the grassroots?

First, I inventory the knowledge related inquiries of farmers in the North Central Region to ATTRA, an alternative agriculture information transfer center located in Arkansas. Then I empirically ground my examination of these research questions in the cognitive praxis of SARE funded farmer-researchers in the North Central region of the U.S. I interpretively analyze the agricultural knowledge generated and the social organizational process by which the knowledge is moved from its local contexts of creation and is shared, and disseminated among the wider community of sustainable agriculturists.
CHAPTER III

METHODOLOGY

Introduction

I approach SARE farmer-researchers as a grassroots community of the broader social movement for sustainable agriculture in the U.S. I view this grassroots community as a social arena where new ideas about agriculture incubate. In this Chapter, I lay out and discuss the analytical framework and the methodological tools I employ for understanding the dimensions of SARE farmer-researchers’ local knowledge and the social organizational framework mediating its transfer to social arenas of interaction where it is validated and exchanged.

I inventory the knowledge-related inquiries farmers in the North Central region make to ATTRA, an alternative agriculture information center based in Fayetteville. I use an interpretive approach to understand the dimensions of the knowledge farmers generate. The purpose is to compare the cognitive dimensions of the inquiries to those reflected in the local experimental practices of SARE research farmers. Congruence between the knowledge queries and the generation of knowledge is an important indicator of SARE’s responsiveness to the felt knowledge requirements of farmers in the region.

The interpretive approach I use in this study attempts to understand the world of lived experience, how people give meanings to their personal experiences and how such meanings shape self perception and action (Denzin, 1989; Miles and Huberman, 1994).
At the core of the interpretive process is the understanding that each individual case is unique and shaped by the experiences of the individual who created it. To understand each case, it is necessary to uncover the voices and actions of the actors through the researcher's reflection on and interpretation of experiences embedded in textual data. Hermeneutics is concerned primarily with that interpretation and the meaning of what is interpreted.

My approach to the data for this research is grounded in and ultimately shaped by the principal tenets of that interpretive paradigm. Accordingly, my methodology is designed as a hermeneutically informed process of “reading” and interpreting symbolic meanings embedded in textual discourse. While I am primarily concerned with agency, that is, farmers’ ability to act and mobilize towards knowledge related processes that undergird alternative agriculture, I direct keen attention to structural factors that nuance and intersect agency. I attempt in my analysis to give voice to the centrality of individual action in mobilizing social change. But I am strongly influenced by the conception of institutional factors as both enabling and constraining structures of human agency.

I find Eyerman and Jamison’s (1991) model of cognitive praxis (described on Pp. 12) particularly useful, in that it offers a novel approach to understanding mobilization processes at that intersection of agency and structure. I adapt and expand the conceptual dimensions of that model to examine the knowledge-related actions of alternative agriculturists in the North Central region, and the mediating institutional factors that influence or shape that process. While SARE farmer-researchers may share a common interest in local experiential knowledge, I argue that they do not constitute a
monolithic entity. Differences in the constellation of personal characteristics and values can be critical in furthering our insights into the potentials and constraints farmers may face in transitioning from standard to alternative agricultural systems.

In the following sections, I provide in-depth descriptions of two sets of data and how they are linked, and I elaborate the dimensions of the analytical framework I initially introduced in Chapter II. I also describe the computer aided process I employ to facilitate my handling, management and organization of a much larger set of textual data than would have been feasible with the traditional manual method of qualitative analysis. Finally, I present a profile of the qualitative research software, NUD*IST (Non-numerical Unstructured Data Indexing Searching and Theorizing) which aided the analytical process.

The North Central Region: Justification for its Selection as Region of Study

Agriculture is a major economic base in the North Central Region. According to a recent North Central region SARE report, that region's agricultural economic base comprises of 45 percent of U.S. farm operators, 41 percent of U.S. farms, 54 percent of total U.S. cropland, and 41 percent of U.S. agricultural products sold (NCR SARE, 1997). Given that background, sustainable agriculture's greatest resource can be viewed as the participants it can attract from the larger population of farmers in this region. Moreover, because the region constitutes a significant proportion of the most important agricultural states in the country, the diversity of experiences/practices that farmer-researchers potentially can contribute has tremendous implications for expanding the knowledge base of sustainable agriculture in the region, and beyond.
Between 1988 and 1992, participants in the USDA’s innovative Sustainable Agriculture Research and Education Program were primarily Land Grant and private sector scientists and extension educators who conducted research and education programs on sustainable agriculture. Farmers were not directly involved.

The North Central Region SARE program became the first regional program to support the direct participation of farmers in sustainable agriculture research and experimentation when it initiated a small grants program for farmers and ranchers in 1992. Other regional SARE programs subsequently emulated that innovative initiative. Because the program was first launched in the North Central region, it is plausible that SARE farmer-researchers in that region may have accumulated a greater store of experiential knowledge and practical insights. Thus the cognitive dimensions of that local experience can contribute to transformative changes in the sustainable agriculture landscape. These two factors ground my justification for selecting the North Central Region and alternative agriculturists in the region as the primary focus of this study.

**Sources of Data: Rationale for Selection**

I analyze 1) inquiries from farmers in the North Central region to an alternative agricultural information center between 1993 and 1997 and 2) the sixty-eight reports available by 1997 of SARE research farmers who had received funding from the North Central Region SARE program between 1992-1995. I seek to identify the broad range of knowledge interests of farmers who make inquiries to alternative institutions of agricultural information and technology in order to understand whether those inquiries
are related to the farmer research activities supported by the NCR SARE producer grant program.

In the SARE Producer Grants' annual "call for proposals" to farmers, prospective participants are invited to undertake research that tests, evaluates and adapts sustainable agriculture practices for their operations and conduct learning circles, educational events, field days or demonstrations as a means of disseminating novel agricultural information to other interested farmers. Farmers can also receive support for developing new and innovative marketing strategies, developing new technologies and adapting or modifying existing agricultural equipment. These invited activities imply that a wealth of experiential knowledge is being generated through farmer research.

An important condition that attends the award of a grant is that the farmer-researcher prepares an annual report documenting activities, experiences and progress towards research goals. A final report is required at the completion of the project. A careful analysis of those reports can yield important insights relating to the cognitive dimensions of farmer local knowledge and how it can promote sustainable agriculture at the grassroots.

Source of Farmer Knowledge-related Inquiries and Matching Responses

The farmer knowledge-related inquiries (and matching responses) from the North Central region between 1993-1997 were obtained from ATTRA (in 1998), an alternative agricultural information center, based in Fayetteville, Arkansas. Established in 1987 by the National Center for Appropriate Technology (NCAT), ATTRA is funded
through a cooperative agreement between the USDA Rural Business - Cooperative Service (USDA-RBS) and the National Center for Agricultural Technology (NCAT).

Located at the University of Arkansas, Fayetteville, ATTRA provides agricultural information in response to inquiries from farmers, extension agents, market gardeners, agricultural researchers and other agricultural professionals in all fifty states. According to a recent online report (www.attra-digest/newsaniv.html), ATTRA receives about 300 inquiries a week for information critical to alternative farming practices and innovative marketing.

In the last two decades alternative agriculture institutions have burgeoned in the U.S. agricultural landscape (DeLind, 1994; Buttel, 1993). The large majority of those institutions are primarily committed to issues of advocacy, outreach and research for sustainable agriculture. Among them are two institutions exclusively directed at meeting the knowledge requirements of farmers seeking information on alternative agriculture: Appropriate Technology Transfer for Rural Areas (ATTRA) and Alternative Farming Systems Information Center (AFSIC). ATTRA is one of the sources of data for this study.

The establishment of ATTRA and AFSIC can be attributed to the activism and advocacy of some professional and academic actors and actors in the NGO community in the movement for sustainable agriculture. The growing interest in sustainable agriculture among those professionals in the 1980s was paralleled by their awareness that the conventional knowledge system is a virtual knowledge vacuum with respect to sustainable agriculture knowledge and technologies (Gerber, 1992; Francis et al., 1990).
Largely as a result of pressure from those advocates, ATTRA and AFSIC were established in the 1980s and subsequently supported by federal grants.

AFSIC specializes in collecting and synthesizing information related to alternative agricultural management practices and agricultural technologies, including alternative crops and livestock. Like ATTRA, AFSIC, based at the National Agricultural Library, is partly supported under the USDA’s Sustainable Agriculture Research and Education (SARE) program. Since the 1980s, many Land Grant colleges have also established research and outreach centers directed at generating, accessing and disseminating information related to sustainable agriculture. The Leopold Center for Sustainable Agriculture in Ames, Iowa and the Minnesota Institute for Sustainable Agriculture in St. Paul, Minnesota are both supported mainly by state funds.

The majority of alternative agricultural institutions, however, are private nonprofit and tax exempt institutions established by individuals, groups, and coalitions working to promote sustainable agriculture at all levels of society. While the primary mission for many of those institutions evolve around research and advocacy, some do systematically move alternative agriculture information to the public realm through periodic newsletters, monographs and online documentation.

However, they are all set up differently than ATTRA and AFSIC. Their main objective is not the collection and dissemination of existing alternative agriculture knowledge but rather a broader support for research and development initiatives for promoting sustainable agriculture. Table 3.1 presents an abbreviated list of some regional and state private, nonprofit sustainable agriculture institutions, their location and types of action in sustainable agriculture.
<table>
<thead>
<tr>
<th>Institution</th>
<th>Location</th>
<th>Type(s) of Action</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bio-Integral Resource Center</td>
<td>Berkeley, CA</td>
<td>Advocacy</td>
<td><a href="http://www.igc.apc.org/birc/">http://www.igc.apc.org/birc/</a></td>
</tr>
<tr>
<td>Center for Holistic Management</td>
<td>Albuquerque, New Mexico</td>
<td></td>
<td><a href="http://www.holisticmanagement.org">http://www.holisticmanagement.org</a></td>
</tr>
<tr>
<td>The Center for Science in the Public Interest</td>
<td>Washington, DC</td>
<td></td>
<td><a href="http://www.cspinet.org">http://www.cspinet.org</a></td>
</tr>
<tr>
<td>Heifer Project International</td>
<td>Perryville, Arizona</td>
<td></td>
<td><a href="http://www.heifer.org/">http://www.heifer.org/</a></td>
</tr>
<tr>
<td>Henry A. Wallace Institute for Alternative</td>
<td>Greenvelt, Maryland</td>
<td></td>
<td><a href="http://www.hawiaa.org">http://www.hawiaa.org</a></td>
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<tr>
<td>Agriculture</td>
<td></td>
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</tr>
<tr>
<td>Institute for Agriculture and Trade Policy</td>
<td>Minneapolis, Minnesota</td>
<td>Advocacy</td>
<td><a href="http://www.iatp.org/iatp/">http://www.iatp.org/iatp/</a></td>
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<tr>
<td>Rodale Institute</td>
<td>Kutztown, Pennsylvania</td>
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<td>Under construction</td>
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<tr>
<td>Lightstone Foundation, Inc.</td>
<td>Moyers, West Virginia</td>
<td></td>
<td><a href="http://www.lightstone.org/">http://www.lightstone.org/</a></td>
</tr>
<tr>
<td>Kerr Center for Sustainable Agriculture</td>
<td>Poteau, Oklahoma</td>
<td></td>
<td><a href="http://www.kerrcenter.com/">http://www.kerrcenter.com/</a></td>
</tr>
<tr>
<td>The Land Institute</td>
<td>Salina, Kansas</td>
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<tr>
<td>Land Stewardship Project</td>
<td>White Bear Lake, Minnesota</td>
<td></td>
<td><a href="http://www.misa.umn.edu/lsphp.html">http://www.misa.umn.edu/lsphp.html</a></td>
</tr>
<tr>
<td>Michael Fields Agricultural Institute</td>
<td>East Troy, Wisconsin</td>
<td></td>
<td><a href="http://www.steinercollege.org/anthrop/mfai.html">http://www.steinercollege.org/anthrop/mfai.html</a></td>
</tr>
</tbody>
</table>
As the table shows, these institutions are involved in a diverse range of activities that include advocacy, research and outreach. Advocacy relates to how such institutions employ arguments and propositions grounded in sound empirical evidence to promote policies and actions that support sustainable changes in farming and in the larger society. The research-related actions of the institutions refer to the support of individuals and groups conducting systematic inquiry on issues that could inform the practice of sustainable agriculture at the grassroots and in the policy arena. The outreach related actions broadly encompass the dissemination of critical agricultural knowledge to farmers and farm families to support sustainable practices on-farm, and in community. ATTRA is very active in that outreach arena.

The specific mission of ATTRA and AFSIC is to compile and disseminate alternative agriculture knowledge to the public. ATTRA directly links all potential clients with a toll-free telephone line and special operators trained to receive knowledge-related inquiries from interested individuals on any aspect of alternative agriculture. By providing a toll-free telephone line, ATTRA connects people interested in alternative agriculture knowledge to a comprehensive database of agricultural information that integrates both conventional agricultural knowledge and sustainable agricultural knowledge. ATTRA maintains a database of all requests and matching information packages prepared by its team of specialists, many of who are trained in the agronomic and livestock production sciences. The activities of ATTRA reflect a process of information flow that can be viewed as inclusive, because it is linked to both the institutionally recognized scientific knowledge system and alternative knowledge, usually
synthesized and compiled in grassroots newsletters, monographs and other non-conventional sources of agricultural information.

ATTRA is linked to the conventional knowledge system through formal documentation and dissemination sources, such as university and national agriculture libraries, electronic databases of scientific agriculture information, and agricultural extension bulletins.

ATTRA is at the same time directly linked to a diverse range of alternative agriculture organizations and groups that synthesize results of alternative agriculture research, including results of farmers' local experiential practices. ATTRA systematically documents experiential knowledge produced individually and collectively by farmers in the form of booklets and monographs. More so than any other identified agricultural information center, ATTRA directly links farmers to alternative agricultural knowledge and conventional knowledge in ways that can support sustainable agriculture. I selected ATTRA for my study based on these factors.

My visit to ATTRA in February 1998 and the insights I gained from informal discussions with some of the specialists guide my selection of the range of inquiries and matching responses for inventory. For example, prior to 1992, information storage was much more complicated and not readily retrievable. That process was upgraded to an electronic online system in 1992, considerably reducing the complexity of managing and retrieving large amounts of information.

Between 1992 and 1997 (a five year period), the ATTRA database had a total of 20,522 inquiries and responses for clients from the North Central Region. I use that entire set of requests and responses to inventory the knowledge interests of farmers in the
North Central region seeking information on alternative agriculture.

**Farmer Knowledge-related Inquiries and Matching Responses: The Analytical Strategy**

While the ATTRA database contains similar knowledge-related inquiries and matching responses for clients from all over the United States, I narrow my universe to only the North Central Region. I determine this to be an appropriate procedure owing to the cross comparative orientation of the study. An important empirical question is whether the range of requests to ATTRA reflects similar or different cognitive domains than those identified in the SARE reports. The degree of congruence between the specific domains of those requests and the knowledge-related activities of SARE farmer-researchers is an important indicator of the relevance of the inquiries and SARE farmer knowledge for other farmers shifting from conventional systems. Logically, I deem it necessary to ensure that both sets of data are from the same universe of farmers in order to facilitate comparisons.

To inventory the knowledge interests of ATTRA clients, I employ a key word search strategy. That strategy is guided by a very comprehensive review of recent public and published discourses on sustainable agriculture and a preliminary overview of both the requests to ATTRA and the research carried out under the SARE Producer Grant Program. I start the review with words used in definitions of the term, sustainable agriculture, and the processes, activities, and outputs and outcomes associated with the implementation and development of sustainable agriculture systems. The purpose is to
identify, as completely as possible, a comprehensive menu of terms and phrases that are pertinent or reflect an orientation to any aspect of sustainable agriculture.

In general, that comprehensive review reveals that while sustainable agriculture defies a unified or simple definition, there is a general convergence of opinion that its roots are grounded in a philosophy and ethic of farming in concert with nature and community. Sustainable agriculture is widely viewed as a systems and agro-ecological management process.

Beyond issues of definitions, sustainable agriculture in much of the literature reviewed generally tends to evolve around a number of key themes. These are a) agronomic, which grapples with the identification and management of alternative crops and livestock, and alternative ways of managing conventional crops and livestock; b) ecological, bio-diversity issues that relate to the environmental and systemic challenges as well as constraints of sustainable agriculture; c) economic, which deals with the potentials and challenges of alternative marketing strategies as well as with the alternative modes of entrepreneurial partnerships for the enhancement of farm and community economic vitality, and d) a social dimension around which evolve discourses on rural community viability, quality of life of farm labor (both household and hired), often nuanced by gender, race, ethnicity and class. These themes are not mutually exclusive and often emerge in the discourse as systemically linked, although the treatment of sustainable agriculture within different disciplinary orientations can often dictate the perspective presented.

Having identified these main thematic issues in the sustainable agriculture literature and in the data, I develop a protocol in which each theme is treated as a
category. The keyword search entails a systematic identification of terms, phrases and concepts in the data generally associated with sustainable agriculture. Specific terms identified are then systematically arrayed with the category to which they are most closely associated. That determination is done by assessing each term against the broad backdrop of literature on sustainable agriculture. If it is determined to be pertinent to a particular category, a frequency count is conducted to identify the number of occurrences or "hits". In other words, the keyword strategy can be viewed as a two step process that constitutes first the identification of sustainable agriculture terms in each request and determining the relevant category under which it can be coded, and second a frequency count to determine its frequency of occurrence.

Owing to the interdisciplinary nature of the concept of sustainable agriculture, many of the terms I find in the data do not fit neatly into any one category. Similarly it is common to find more than one sustainability-related term or phrase in a single inquiry or response. Multiple terms in one inquiry are not deemed problematic, however. This is because the intent is not to compare but to highlight the frequency of occurrence of key sustainability related terms as an indirect or unobtrusive indicator of the extent to which the knowledge related inquiries reflect an interest in sustainable agriculture.

The challenge, therefore, is to be able to identify all terms and phrases embedded in the inquiries and matching responses that are related to sustainable agriculture. Those frequencies of occurrences of the terms are then compared to the knowledge-related practices of the SARE farmer-researchers in the North Central region who participated in the SARE Producer Grant Program between 1992 and 1995. In the next section, I present
an in-depth description of the SARE farmer-researcher reports and the procedure employed in analyzing them.

**Source of SARE Farmer-researcher Reports**

In 1985, the United States Congress authorized the Sustainable Agriculture Research and Education Program (SARE) in response to pressure from the sustainable agriculture movement for greater institutional support of research geared towards the enhancement of environmentally sound and socially responsible agriculture systems. While initially dominated by university and private non-profit sector agricultural scientists, the program was expanded in 1992 to directly support agriculturists. That funding supported and continues to support farmers who work with university scientists to test innovative alternative agricultural technologies and creative marketing strategies that link farm and community in ways that enhance environmental and social capital.

Since its inception in 1992 through 1997 the North Central Region SARE Producer Grant Program (NC SARE-PGP) has awarded over three hundred grants to farmers in that region to support their on-farm inquiry and local practices on agricultural issues of direct relevance to their production enterprises.

Between 1992 and 1995 (according to the 1997 NCR SARE Operations Committee Report), the North Central Region Producer Grant Program awarded a total of 158 producer grants under eight categories: 1) crop production systems, 2) weed control, 3) composting and waste management, 4) specialty crops, 5) organic farming and gardening, 6) livestock management, 7) biological and non chemical pest control and 8) special topics.
A key requirement of the grant is that project grantees submit annual progress reports and, at the end of a project, a final report detailing process, outputs and outcomes of the research. The format of the reports is accompanied by a set of guidelines and questions that grantees are required to respond to. These are sent out to every grant recipient. A copy of those guidelines for submission of reports is included in Appendix A.

The final reports are from the universe of projects funded between 1992 and 1995. The selection of the time periods was based on an assumption that most if not all projects funded within that time period would either be complete or nearing completion, and that a final, as opposed to an annual or interim report, would be available for analysis. A total of 125 producer projects received funding between 1992 and 1995, as reported in the 1997 NCR SARE Operations Committee Report. That distribution is shown in Table 3.2.

Table 3.2: Status of SARE Funded Projects- 1992-1995 (as of March, 1997)\(^{a}\)

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<td>Complete</td>
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<td>30</td>
<td>23</td>
<td>0</td>
<td>73</td>
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<td>Active/Extended</td>
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<td>0</td>
<td>8</td>
<td>38</td>
<td>49</td>
</tr>
<tr>
<td>Inactive</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Totals</td>
<td>24</td>
<td>31</td>
<td>31</td>
<td>39</td>
<td>125</td>
</tr>
</tbody>
</table>

\(^{a}\)Figures were obtained from the 1997 North Central Region-SARE Program Operations Committee report and update for fiscal year 1996.
Three of the projects became inactive during that period and were not completed. Seventy-three projects were completed by 1995, while forty-nine were either still active or had been extended. Three of the projects became inactive during that period and were not completed. Seventy-three projects were completed by 1995, while forty-nine were either still active or had been extended. My total number (N) of available reports is sixty-eight.

**SARE Farmer-researcher Reports: The Interpretive Analytical Strategy**

My main goal is to analyze a process by which SARE farmer-researchers have come to take action at the level of their farms to create new knowledge. In identifying and tracing thematic patterns and regularities across the reports, I employ “thick description” while reading and interpreting symbolic meanings embedded in texts and discourses as related to the empirical categories identified in the conceptual framework of the study.

To guide my analysis of the knowledge-related activities of SARE farmers, I heuristically identify a number of sub-dimensions under the theoretically relevant categories I adapt from Eyerman and Jamison’s model of cognitive praxis discussed in Chapter II. The categories are a) the knowledge and technical elements (as well as processes resulting from action), b) the underlying philosophical tenets that undergird the research and sharing the research, and c) the social organizational processes that link the creation, sharing and dissemination of knowledge. I schematically delineate the empirical dimensions of that framework in Figure 3.1.
My approach takes as its point of departure the work of Alfred Schutz (1977), who argues that the actions performed by human beings are intelligible only within individuals' personally constructed value systems. According to Schutz, one cannot realistically draw conclusions from any set of human action unless one creates a model that closely reflects that subject's mental model. Norman Denzin (1978) has reiterated the significance of examining the subject's experiential reality through the "thought objects"
that subjects construct to order their day to day lives in the social world. He postulates that

Human social phenomena can be validly and productively "ordered" and thereby understood when examined micro-historically: that is to say, as "joint acts" of "native persons" who are linguistically generated, flowing from the actors' interactive conceptions of reality, meaning and value. These acts can be approached from both the outside and the inside in a mutually confirming manner. This is possible through the medium of speech as it constitutes the situation and as it reveals the private states of mind of the actors. Speech in this sense, includes actions, both as the culmination of thoughts and perceptions and as themselves, forms of speech, which convey meaning not only concurrently but retrospectively across time (1977:56).

Thus the cognitive sub-dimensions developed for this analysis can be viewed as a network of knowledge elements that taken together shape social actors' actions for social change. The schematic illustrates the "knowledge elements" categories as applied to each unit in the analysis. It must be noted, however, that the empirical categories delineated are merely sensitizing constructs to guide analysis and not an attempt to impose meaning or lead the analyses of data. In my preliminary exploration of the texts, those terms emerge as "interesting" concepts that appear to fit under the theoretically relevant categories adapted from Eyerman and Jamison's model of cognitive praxis. My subsequent, more systematic exploration of the texts is guided by those initial empirical constructs that have been previously identified.

Researchers often posit that a close connection exists between language and culture to the extent that some even claim that the changing use of language can be
viewed as a primary signal that culture is being re-formed (Busch, 1978). Such a change is seen, even more clearly, in the development of a new system of thought or a different way of creating knowledge. Rochon (1998) maintains that cultural processes are difficult to study because of the highly decentralized way in which they take place. But, because the link between values and public discourse often leaves an observable imprint in the form of new ideas and new philosophical positions, one can observe that cultural transformation process by examining the texts in which they are embedded.

Each SARE farmer-researcher report is interpretively "read" to identify the social meanings and type of knowledge directly conveyed or inferred linguistically and symbolically by the text. SARE farmer-researcher reports on their context-based research processes, outputs and outcomes are thematically teased apart. Themes and semantic expressions that either directly or symbolically reflect how farmers explain their participation in the SARE program are discussed.

As is common with qualitative research, findings from this research flow concurrently with the discussion of findings as they emerge in context. Because both sets of data used for this study are natural outcroppings of data originally gathered for another purpose, it is necessary to note that the analysis constitutes an interpretation of the ideas, themes and information as constructed in the texts and is not an observation of actual processes as they occurred in the context of farmer practices. They were constructed by the individual writing the report to meet the perceived demands and worldview of the funding entity.
Computer-Aided Data Analysis

The process of multiple comparison is aided by the use of a qualitative software program, NUD*IST (Non-numerical Unstructured Data Indexing Searching and Theorizing). Like many other recent qualitative data computer applications developed in the late 1980’s and early 1990’s, NUD*IST is principally designed to support qualitative research in the tradition of grounded theory (Udo Kelle, 1995). Developed by Barney Glaser and Anselm Strauss in the 1960s, grounded theory is a process of inductive generation and provisional verification of sociological hypotheses and theories from empirical data.

The theory is based on an analytic process of detailed reading of textual data in order to identify concepts and related phenomena that can be coded and grouped into categories. The process involves identifying relationships between and among phenomena and inductively developing ideas (recorded as memos) that ultimately develop into an abstract theoretical structure. Its defining principle is that theory emerges out of the context of the research process as opposed to guiding that process.

The design of NUD*IST draws directly from that grounded theory approach. That however, does not preclude its use in research that builds on other theoretical frameworks. Fisher (1997) argues that at the core of any qualitative analysis, whether manual or computer-aided, is the very complex process of organizing, managing and storing data in a way that can facilitate retrieval and re-threading into coherent accounts. All qualitative computing software supports that fundamental data organization and storage process, while some, like NUD*IST, can move analysis further into the inductive theory building process.
While finding the organizational potential of the NUD*IST program highly useful, my research nonetheless charts a different analytical course, one that is clearly theoretically informed. I consciously approach the use of the program not as an aid to an inductive theory building process, but as a strategic tool for isolating and coding concepts embedded in the textual data that relate to a clearly defined theoretical framework. I find Eyerman and Jamison’s (1991) cognitive praxis, grounded in social movement theory and the sociology of knowledge, particularly useful in helping me analyze the knowledge creation and exchange processes of alternative agriculturists. Accordingly, the broad categories and dimensions highlighted by Eyerman and Jamison become my “theoretical guideposts” in the systematic analysis of the textual data.

The NUD*IST program makes two important contributions to my interpretive approach. First it facilitates the management of the multiple linkages that I identify between text segments as well as between nodes at which I code concepts that I find to be theoretically relevant. Codes serve as representations of perceived meanings of investigated phenomena that emerge out of the interpretive process (Richards and Richards, 1995). The codes are not ends in themselves, but intermediate processes that facilitate the intuitive and interpretive process of sense making and meaning construction.

Moreover, because the program design facilitates the development of memos, it supports a high degree of iteration and reflexivity, as emergent ideas can be looped back to previous ones either to enhance conceptual clarity or for purposes of comparison, evaluation and fine tuning (Fisher, 1997). Memos primarily function as containers for storing conceptual understandings and evolving ideas. They are particularly important for analyzing large qualitative data sets.
The second contribution that NUD*IST makes to this study is in the way it facilitates the systematic application of the same conceptual elements across a large amount of textual data in a relatively limited time. Marshall and Rossman (1995) maintain that the ability to utilize a larger set of data adds greater breadth to the scope of analysis, while maintaining depth of interpretation. The use of a qualitative software for multiple data analysis allows the “spread” of the empirical categories across a much larger number of reports than is realistically possible if the texts are organized manually. Through that coding and spreading technique, I develop a detailed set of categorical maps of phenomena, including their occurrence and regularities, while distilling meaning emerging from that context into a coherent account. Moreover, the program not only facilitates the identification of the full range of data relevant to the concepts identified, but it also generates frequencies of related codes and their distribution across the “cases” or reports.

**Limitations of the Study**

One limitation in this study was an inability to explore beyond the questions clients asked ATTRA. Owing to the constraints of time and resources, only secondary sources of data could be employed in the study. For example, a question such as whether new knowledge resulting from the testing out of ATTRA technologies and ideas gets fed back into the ATTRA repository was not pursued. Clients’ perceptions of the agriculture-related knowledge from ATTRA could have illuminated the institution’s responsiveness to clients’ felt needs. Further research into the alternative knowledge
flow processes of ATTRA would be useful in the continued understanding of the role of such institutions in the promotion of grassroots activism for sustainable agriculture.

Another limitation relates to the general nature of the guidelines that SARE farmer-researchers used in preparing reports to their funding agency. While the guidelines provided opportunity for farmers to describe their experiences, it tended to limit the depth and scope of farmers' responses. Further, for many farmers, writing is not the preferred or most comfortable form of communication.
CHAPTER IV

ANALYSIS AND DISCUSSION

Introduction

This chapter is divided into two main sections. In the first section, I present and discuss results of my inventory of the knowledge-related inquiries and matching responses to ATTRA from agricultural clients in the North Central region between 1993-1997. As a backdrop to that inventory, I present a geographic profile of the ATTRA clients who made inquiries from the region and compare their distribution to the regional profile of farmers in the North Central region as reported in the 1992 national census of agriculture.

In the second section, I present the distribution of SARE farmer-researchers whose reports comprise the secondary data used in the study. I interpretively analyze and discuss SARE farmer-researchers' reports of the knowledge generated in their local inquiry and the social organizational framework that mediates its creation and exchange among the larger community of alternative agriculturists.

The analysis provides primarily a linguistic reading and interpretation of symbolic interconnections, linkages and patterns of relationships embedded in the reports. More specifically, it focuses on 1) the knowledge-related questions addressed in farmer research 2) the goals sought, 3) the kinds of knowledge/practice emerging from the context 4) the institutional changes supporting that new system and, 5) the
participatory process mediating the creation and dissemination of emergent local knowledge/practice to the broader movement community.

Finally, I relate the dimensions of the knowledge-related inquiries to ATTRA to the knowledge generated by SARE farmer-researchers in the region. My goal is to establish the extent to which these two knowledge sources are congruent or reflect similar cognitive domains.

The Knowledge Related Inquiries and Matching Responses

Four questions lead to my analysis and discussion of the knowledge related inquiries from the North Central region. Do the inquiries to ATTRA reflect an orientation to alternative agriculture practices? Are the ideational and value underpinnings of those knowledge-related inquiries in resonance with the broader principles of alternative agriculture? How are agriculturists seeking knowledge on alternative agriculture practices distributed in the North Central region?

In this section, I present the results of the inventory of the knowledge-related inquiries and its specific dimensions as it relates to these questions. I also specifically relate the inquiries to the research categories outlined in SARE Producer Grant requests for proposals. First, I preface that analysis with a distribution of the knowledge-related inquiries. I take that distribution as an unobtrusive measure of the pattern of representation of ATTRA clients in the North Central region. The percentage distribution of inquiries is presented in Figure 4.1
Figure 4.1: Percent Distribution of ATTRA Knowledge-related Inquiries and Matching Responses by State \(^4\) in the North Central Region (N = 20,522).

I also compare the distribution of ATTRA clients to the regional distribution of farmers in the North central region (Figure 4.2).

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\(^4\) Abbreviations represent the following North Central region states- Illinois, IL; Iowa, IA; Kansas, KS; Michigan, MI; Minnesota, MN; Missouri, MO; Nebraska, NE; North Dakota, ND; Ohio, OH; South Dakota, SD; Wisconsin, WI.
Figure 4.2: Percent Distribution of Farmers by State in the North Central Region

Figures are computed from the 1992 National Census of Agriculture (N = total # of farmers in 1992).

Figure 4.1 shows a concentration of ATTRA clients in some parts of the North Central Region. Wisconsin, Missouri and Minnesota have the highest concentrations, while the Dakotas and Nebraska have the lowest number of clients. Compared to the regional distribution of farmers in the North Central region (Figure 4.2), Wisconsin,
Missouri and Minnesota have proportionately higher distributions of ATTRA clients than the regional distribution of farmers for the states.

These figures demonstrate that farmers in those states may have more interest in sustainable agriculture-related knowledge than farmers in other states. The figures do show, however, that a proportionately higher number of agricultural clients in those states seek agricultural knowledge on alternative management systems and technologies from an alternative agriculture information center. This can be viewed as an implication that some farmers may either be shifting or planning to shift to alternative and therefore more sustainable agriculture.

It is also pertinent to note that while the majority of inquiries are from farmers, other clients not directly involved in agricultural production also make inquiries to ATTRA. Among those clients are university professors, extension agents, high school teachers, and 4-H coordinators seeking information on alternative agriculture management, a clear indication that ATTRA’s database of alternative knowledge serves a broad base of agricultural clients, not just farmers.

While the specific number for each category of clients could not be determined owing to the unstructured nature of the documented data, some important implications for the promotion of sustainable agriculture emerge. First, the introduction of alternative agriculture ideas and concepts in high schools imply a potentially early orientation to, and sensitization of young individuals to sustainable agriculture. Second, other agriculture actors, including college professors in the agricultural sciences and extension specialists, find ATTRA’s knowledge base useful, indicating an interesting melding or interfacing of alternative and scientific agricultural knowledge.
The diversity reflected in the range inquiries relating to alternative practices and technologies in the region shows that a cognitive interpretation of the knowledge interests reflected in agricultural clients' inquiries could strategically guide research and outreach most relevant to the requirements of farmers seeking to transition from standard to alternative systems of agricultural production.

Mediating On Farm Shifts to Alternative Agriculture: The Role of ATTRA

As institutions emerge linking a broader knowledge base to more diverse agricultural clienteles, it becomes necessary to understand underlying value and technical dimensions of the knowledge interests of agricultural clients, as well as related responses from their alternative sources of knowledge. I argue that to the extent that a substantial percentage of clients' inquiries either directly or indirectly reflect topics related to sustainable agriculture, institutions such as ATTRA can be viewed as important linkages to knowledge relevant to alternative agriculturists' local inquiry and management practices.

Results of Keyword Search of Knowledge Related Inquiries from the NCR

I carried out a keyword search of 20,522 matching knowledge-related inquiry-responses between 1993-1997 from the ATTRA database in order to determine their technical dimensions. I also systematically compare them to the local experiential knowledge of SARE farmer-researchers in the North Central region. My purpose is to determine the degree of congruence between two knowledge sources: SARE farmer-researchers, who create knowledge, and ATTRA, which disseminates knowledge.
As detailed in the methodology, that process is guided by a comprehensive and intensive review of the literature on sustainable agriculture in order to identify words and key phrases conventionally associated with or reflective of an orientation to sustainable agriculture. The research categories delineated in the SARE Producer Grant Program requests for proposals reflect a broad range of subjects relating to sustainable agriculture and were very useful guides to the identification of additional keywords and phrases. I also draw on recent empirical studies that employed a similar keyword strategy to determine the level of responsiveness of public institution agricultural scientists' research to emergent sustainable agriculture issues (e.g. Lipson, 1997; Bird, 1995; Schaller, 1986).

Because the questions documented in the ATTRA database crosscut a broad array of issues on sustainable agriculture, I aggregate the main elements embedded in each inquiry and response under four broad categories or themes- crops, livestock, marketing and mixed or integrated themes. I discuss these themes in turn.

Crops

An important indicator of an alternative agriculture system is the type of crop and management strategy employed in its production (Jackson, 1984; Todd, 1984). Crops that are not conventionally grown on large scale or grown for high volume and are instead produced to meet specialized niche demands are usually recognized or referred to as specialty or alternative crops. Partly because such crop production systems do not have the benefit of institutionally supported marketing mechanisms, they are usually relatively smaller in scale (and low input). Management strategies for
those crops can evolve around the systemic manipulation of natural ecological processes, such as crop rotations and integrated management systems to support high yield production.

Advocates of sustainable agriculture view the production of such agricultural products and cropping practices as important indicators of sustainability (Gliessman, 1984; Todd, 1984). Thus I take their frequency in the matching inquiry responses to be a reflection of that interest among farmers in the North Central region. Among the specialty crops of interest to clients in the region, organic corn, organic soybeans, a variety of organic fruits and vegetables including blueberries, raspberries, apples, tomatoes and onions are among the highest number of keywords or "hits" that came up in the search.

The keyword search shows that these themes are not mutually exclusive in either the inquiries or matching responses from ATTRA. In effect, a single inquiry tends to be loaded with multiple queries or requests. Therefore one inquiry may contain more than two keywords. Thus the search determines the frequency of occurrence of each keyword in the data and not the number of inquiries asking sustainability questions.

**Livestock**

Keywords coded under this theme relate to inquiries about animal production systems different than confinement systems. The large-scale livestock systems in the U.S. favor the confinement of large numbers of animals in restricted manufactured environments as a management strategy. Part of that management strategy includes
meeting nutritional requirements of animals through processed feeds, artificially fortified with antibiotics and chemical additives.

Because of the unintended negative social and environmental consequences of that approach to livestock production, advocates of sustainable agriculture see shifts from that confinement system as important indicators of sustainable agriculture. Accordingly, keywords that relate to any alternative to confinement as a livestock management strategy are coded under this theme.

Advocates of sustainable agriculture also tend to identify specialty animals (those livestock not conventionally managed as large-scale livestock production enterprises) as important indicators of sustainable livestock systems. This is because their management often relies (in contrast to conventional livestock production) on natural agro-ecological processes to meet health and nutritional requirements.

As with the crops theme, I take the frequency of occurrence of keywords that relate to any alternative to conventional livestock management or to specialty livestock to be an indicator of the level of interest in alternative livestock production systems among clients in the North Central region. Indeed leading among the keywords with the highest number of "hits" under this theme are pastured poultry/chicken production, pastured hog production and rotational grazing.

**Marketing**

An important limitation in alternative agriculture relates to a relatively weak market infrastructure to support farmers involved in the production of alternative agricultural products (National Commission on Small Farms, 1998). In response to that
challenge, innovative marketing alternatives that link farmers directly to local communities while eliminating intermediaries are growing in many rural communities, and urban areas, in recent years (Kloppenburg et al., 1996).

Among those alternative marketing channels is Community Supported Agriculture (CSAs), where farmers forward contract products and consumers pay in advance to minimize the burden of risk on the farmer, while ensuring non chemically grown food products preferred by the consumer. Interests in such alternative marketing channels are important indicators of sustainability to the extent that they reflect an orientation to agricultural products not conventionally supported by the institutionalized marketing infrastructure. The marketing infrastructure generally tends to favor high volume, low value commodities, not products. Those alternative markets are also significant in the search. Community Supported Agriculture, for example yielded 897 successful "hits" and direct marketing yielded 366 successful "hits" from the computer aided keyword search.

Mixed Themes

The mode of documentation of client inquiries and their matching responses are not guided by a standard format. As a result there is wide variation in the terms and combination of words used to document them. That resulted in significant overlaps among themes. Thus where keywords do not neatly fit under any of the three categories discussed above, I categorize them under what I refer to as mixed themes. The "hits" coded under this theme include, but are not limited to, keywords found in inquiries that relate to integrated crop and livestock systems.
A complete list of keywords used in the search (81), and the number of times the keywords or "hits" came up in the data are shown in Table 4.1. The "hits" are aggregations of keywords and their synonyms, as used in the documentation. (For example the keyword "organic" is variously documented as "org", "orgn". Similarly, the keyword "sustainable" occurs as "sus", "sust" and "sustain" across the range of inquiries).

The Table shows 4583 successful hits under the “crops” theme, 1245 under “livestock”, 1173 under markets and 8813 under the “mixed” theme. The latter category predominantly contained inquiries related to integrated crop and livestock management systems. The frequencies of occurrence of the keywords do not directly confirm that only inquiries related to sustainable agriculture are asked of ATTRA. However, they do suggest that there is an interest in sustainable agriculture knowledge among farmers in the region. Indeed as evidence from a recent publication from ATTRA shows (ATTRA, March, 1997), the number of clients from the North Central region increased from 2000 in 1992, to 18000 in 1996, a nine hundred percent increase.

While there are variations between states in the region as shown in Figure 4.1 and Figure 4.2, these trends, taken together, show evidence overall of growing interest in alternative agriculture knowledge in the North Central region.
Table 4.1. Results of Keyword Search of Matching Inquiry-Responses-1993-1997

<table>
<thead>
<tr>
<th>Keywords</th>
<th>Number of &quot;Hits&quot; or Occurrences</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Crops</strong></td>
<td></td>
</tr>
<tr>
<td>Cover Crop(s)</td>
<td>836</td>
</tr>
<tr>
<td>Specialty Herb(s)</td>
<td>699</td>
</tr>
<tr>
<td>Integrated Pest Management</td>
<td>355</td>
</tr>
<tr>
<td>Compost</td>
<td>342</td>
</tr>
<tr>
<td>Soil Amendments</td>
<td>309</td>
</tr>
<tr>
<td>Soil Fertility</td>
<td>286</td>
</tr>
<tr>
<td><em>Green Manure</em></td>
<td>263</td>
</tr>
<tr>
<td>Crop Rotation(s)</td>
<td>241</td>
</tr>
<tr>
<td>Manures</td>
<td>220</td>
</tr>
<tr>
<td>Non-conventional Soil Treatment</td>
<td>165</td>
</tr>
<tr>
<td>Hydroponics</td>
<td>145</td>
</tr>
<tr>
<td>Biological Fertility</td>
<td>124</td>
</tr>
<tr>
<td>Worm(s)</td>
<td>114</td>
</tr>
<tr>
<td>Earthworms</td>
<td>105</td>
</tr>
<tr>
<td>Mulch</td>
<td>75</td>
</tr>
<tr>
<td>Soil Biology</td>
<td>73</td>
</tr>
<tr>
<td>Soil Environment</td>
<td>61</td>
</tr>
<tr>
<td>Soil Env.</td>
<td>47</td>
</tr>
<tr>
<td>Composting</td>
<td>41</td>
</tr>
<tr>
<td>Agroforestry</td>
<td>23</td>
</tr>
<tr>
<td>Nitrogen-fixing</td>
<td>11</td>
</tr>
<tr>
<td>Humus/Humate</td>
<td>10</td>
</tr>
<tr>
<td>Beneficial Insects</td>
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<tr>
<td>Inter-cropping</td>
<td>7</td>
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<tr>
<td>Open-pollinated</td>
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</tr>
<tr>
<td>Bio-systems</td>
<td>4</td>
</tr>
<tr>
<td>Composted</td>
<td>4</td>
</tr>
<tr>
<td>Soil Organism</td>
<td>4</td>
</tr>
<tr>
<td>Beneficial Microorganism(s)</td>
<td>3</td>
</tr>
<tr>
<td>Polyculture</td>
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</tr>
<tr>
<td>Allelopathy</td>
<td>1</td>
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<tr>
<td><strong>Sub-total</strong></td>
<td><strong>4583</strong></td>
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Table 4.1 (continued)

<table>
<thead>
<tr>
<th>Keyword</th>
<th>Number of “Hits” or Occurrences</th>
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<tbody>
<tr>
<td><strong>Livestock</strong></td>
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</tr>
<tr>
<td>Specialty Animals</td>
<td>684</td>
</tr>
<tr>
<td>Pasture Management</td>
<td>251</td>
</tr>
<tr>
<td>Rotational Grazing</td>
<td>214</td>
</tr>
<tr>
<td>Pastured Hogs</td>
<td>44</td>
</tr>
<tr>
<td>Intensive Grazing</td>
<td>29</td>
</tr>
<tr>
<td>Pastured Chicken</td>
<td>18</td>
</tr>
<tr>
<td>Grass-based Management</td>
<td>5</td>
</tr>
<tr>
<td><strong>Sub-Total</strong></td>
<td><strong>1245</strong></td>
</tr>
<tr>
<td><strong>Markets</strong></td>
<td></td>
</tr>
<tr>
<td>Direct Marketing</td>
<td>881</td>
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<tr>
<td>Community Supported Agriculture</td>
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<td>Farmers’ Markets</td>
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<td>Niche Marketing</td>
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<tr>
<td><strong>Sub-total</strong></td>
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<tr>
<td><strong>Integrated</strong></td>
<td></td>
</tr>
<tr>
<td>Organic</td>
<td>3713</td>
</tr>
<tr>
<td>Sustainable/sus/sust agriculture</td>
<td>2916</td>
</tr>
<tr>
<td>Diversified</td>
<td>705</td>
</tr>
<tr>
<td>Small-scale Farmer</td>
<td>669</td>
</tr>
<tr>
<td>Alternative</td>
<td>378</td>
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<tr>
<td>Natural Farming</td>
<td>147</td>
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<tr>
<td>Nutrient Recycling</td>
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<td>Farmscaping</td>
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<tr>
<td>Specialty Production</td>
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<td>Environmentally Safe Production</td>
<td>48</td>
</tr>
<tr>
<td>Biodynamic</td>
<td>8</td>
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<tr>
<td>Low-input Farming</td>
<td>6</td>
</tr>
<tr>
<td>Bio-control</td>
<td>6</td>
</tr>
<tr>
<td>Biodiversity</td>
<td>4</td>
</tr>
<tr>
<td>Beneficial Microbial Activity</td>
<td>4</td>
</tr>
<tr>
<td>Non-chemical</td>
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<tr>
<td>Holistic</td>
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</table>
Table 4.1 (continued)

<table>
<thead>
<tr>
<th>Keywords</th>
<th>Number of “Hits” or Occurrences</th>
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<td>Transitioning Farmer</td>
<td>3</td>
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<tr>
<td>Cultural Control</td>
<td>1</td>
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<tr>
<td><strong>Sub-total</strong></td>
<td><strong>8813</strong></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>15814</strong></td>
</tr>
</tbody>
</table>

Sources of Information for ATTRA

ATTRA intersects with multiple networks of information in order to increase responsiveness to the knowledge interests of different groups of agriculturists as changes in the structure of agriculture create new categories of farmers in the agricultural economy. Those networks crosscut both alternative as well as conventional sources of information.

ATTRA manages a specialized library collection, called its resource center, derived from synthesizing the wide range of sustainable agriculture related knowledge pooled from their multiple networks. The resource center includes over 4000 catalogued monographs, over fifty regular subscriptions to journals, newsletters, publisher and supply catalogues, and a video tape collection.

The resource center also manages a vertical file system that organizes articles, bulletins and reprints by topic (personal communication, ATTRA Library specialist, 1998; www.attra-digest/newsaniv.html). In Appendix B, I present examples of ATTRA's sources of agricultural information, which include sources commonly
sources are typically experiential knowledge of farmers and other social actors at the grassroots, farm profiles, results of on-farm experimentation, often in collaboration with institutional professionals.

ATTRA's sources of knowledge include broad array of alternative agriculture institution newsletters, monographs and research notes that usually synthesize the experiences of farmers experimenting in alternative practices. The institution subscribes to over 60 published newsletters from every state in the country. ATTRA has also forged important linkages with conventional knowledge systems, tapping the diverse databases and other institutional resources for scientific agricultural knowledge.

ATTRA's technical specialists who are all well trained professionals in a variety of agricultural and communication disciplines, routinely draw on this broad-based database to synthesize innovative agricultural information specifically tailored to the particular interests of their clients. ATTRA's process of synthesizing and moving knowledge to grassroots actors can be viewed as not only innovative but revolutionary in that it breaks down the formal boundaries between conventional scientific knowledge and localized experiential knowledge in its attempt to be responsive to the specialized needs of its diverse clientele.

ATTRA is emerging as an important resource in the movement for sustainable agriculture, as reflected in the diversity of sustainability inquiries to which it responds. How congruent are the knowledge interests reflected in clients' sustainability inquiries to the local funded farmer research in the region? In the next section, I analyze the dimensions of SARE farmer-researchers' local knowledge as constructed in their
reports, and relate the findings to the knowledge interests of farmers in the North Central region.

**SARE Farmer-researchers as Cognitive Actors**

Alternative agriculture can be viewed as a grassroots expression of a broader social movement for sustainable agriculture (Buttel, 1993; Hassanein and Kloppenburg, 1995). That observation lays the foundation for a new social discourse on the actions of alternative agriculture adherents and related social organizations. But relatively few studies attempt to empirically understand the cognitive basis of alternative agriculturists' self-definitions and action strategies, or the range of resources that support their processes of mobilization.

I argue, following Eyerman and Jamison (1991) and Wainwright (1995), that it is critical to understand how movement actors think, why they think the way they do, and how those thoughts can dialectically inform action. While building on that cognitive process, I extend the boundaries of my analysis to encompass a view of alternative agriculture farmers as transformative agents of social change in the rural and agricultural landscape, rather than merely oppositional elements in a dominant culture.

Through an interpretive "reading" of SARE farmer-researcher reports from the North Central region, I map the social processes by which the knowledge created out of their research is cognitively shaped, developed and organized as a grassroots expression of a social movement for sustainable agriculture. Following the relevant domains of theoretical interest delineated in the previous chapter, I first identify the underlying values and beliefs symbolically embedded in the farmers' reports. I focus
on what Rochon (1998) refers to as value conversions and the events promulgating them in specific situations. Value conversions imply that culture is dynamic, not static, and changing cultures explain changing actions of individuals in society.

I then interpret the relationships between those values and the documented agricultural practices that are the subject of research. I discuss the critical technical knowledge generated in the research process and the social organizational framework within which knowledge creation and exchange are intertwined and mediated as "praxis". Finally, inferring from the empirical dimensions analyzed (the underlying value dimension, the technical and social organizational dimensions), I summarize the process by which those dimensions dialectically reconfigure and extend the boundaries of possible knowledge.

The analytical challenge is not to merely 'map' those dimensions as if they were frozen in time and place. To do so would deny the processual and relational nature of farmer-researchers' practices. Indeed, while I recognize that those dimensions can constitute the knowledge creation and exchange activity, conceptually, I treat the dimensions as structurally and dynamically interwoven, each shaping the boundaries of the other. As such, their treatment as separate categories in this study is only a heuristic strategy to facilitate analysis and conceptual clarification.
Why Do Farmers Do What They Do? Goals of SARE Farmer-researchers

The driving forces behind SARE farmer actions and choice of farming practices emerge clearly from their reports. They fall into three distinct but overlapping categories or value sets: environmental stewardship, economic viability and social sustainability.

Environmental stewardship broadly refers to an ethic of farming that values the natural resource base in itself (land, water, air), while recognizing that that resource base is something to be protected and conserved, even as it is manipulated for human survival. Social sustainability broadly encompasses the value of relationships, quality of life and social justice. Economic viability, as reflected in SARE farmer-researchers' reports, relate to the ability to operate a farming operation whose net returns exceed its net expenditures consistently through time.

I take the regularity of recurrence of each category, as reflected in the texts, to be a salient indicator of the importance of that underlying value that can in turn, shape the actions, and critical decisions farmers make in relation to their agricultural processes. Table 4.2a shows the number of reports that mention each element.

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5 To ensure anonymity, I use capital letters wherever names of individuals appear in statements and quotes contained in the reports.
Table 4.2a: Reasons for Participation in the SARE Grant Program

<table>
<thead>
<tr>
<th>Reasons for Participation</th>
<th>Farmer-researcher Reports that Mention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Stewardship</td>
<td>52</td>
</tr>
<tr>
<td>Economic Viability</td>
<td>43</td>
</tr>
<tr>
<td>Social Sustainability</td>
<td>14</td>
</tr>
</tbody>
</table>

The values identified are not mutually exclusive. However, it is possible to determine, based on their responses to the set of pre-defined guidelines that SARE farmer-researchers use to write their reports, which values have greater or more direct weight in shaping farmers' decision to participate in the SARE program. Out of the sixty-eight farmer-researcher reports, 76.4 percent acknowledge the importance of ecological/environmental values. Sixty-four percent of the reports reflect an emphasis on financial viability as an impetus for their participation in the SARE Producer Grant Program while twenty percent mention social sustainability. However, while some farmers ascribe direct importance to only one of the categories identified, others identify more than one category as important in shaping their choices of agricultural practices. This reflects some differences among farmers, notwithstanding their common interests in alternative agriculture knowledge and practice. Table 4.2b shows the overlap among the reasons SARE Farmer-Researchers Give for participating in the SARE program.
Table 4.2b: Overlaps Among the Categories Identified in SARE Farmer-Researchers’ Reports

<table>
<thead>
<tr>
<th></th>
<th>Environmental Sustainability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Sustainability</td>
<td>Yes</td>
</tr>
<tr>
<td>Yes Economic</td>
<td>Yes</td>
</tr>
<tr>
<td>Viability</td>
<td>No</td>
</tr>
<tr>
<td>No Economic</td>
<td>Yes</td>
</tr>
<tr>
<td>Viability</td>
<td>No</td>
</tr>
<tr>
<td>Total</td>
<td>54</td>
</tr>
</tbody>
</table>

The table shows that three farmers identify all three sustainability reasons for their participation in the SARE program. Thirty-one farmers indicate economic and environmental sustainability concerns but do not refer to any social sustainability concern as a factor in their participation. Two farmers mention social sustainability reasons only. Eleven farmers mention only environmental sustainability reasons for their participation, while 11 farmers stated economic reasons only. This suggests that SARE farmer-researchers’ participation in local inquiry may be the result of a complex interplay of factors, although, as Table 4.2a shows, some factors hold greater weight than others. In the following section, I discuss my interpretive analysis and implications relating to those values and the overlaps among them.
Environmental/Ecological Stewardship

Farmer-researchers' participation in the SARE program can be seen as a concrete reflection of firmly held values that define the relationship of self to nature and community in a stewardship and social justice framework. Statements from each farmer report that placed emphasis on ecological stewardship as the impetus for their participation in a sustainable agriculture program are coded under the category “environmental stewardship”. And as Table 4.2a shows 52 (76.4%) reports were coded under this category.

The values of environmental stewardship, though complexly intertwined with other underlying values, are evident as motivating factors in sustaining SARE farmer-researchers' interests in participating in on-farm research. As one farmer-researcher put it,

> [O]ur objective, increased diversity, was achieved through more accurately mimicking the key pressures that shaped the diverse prairie. Our grazing system can be viewed as a miniature prairie: solar energy is the primary input. Plant, animal and soil health, are interdependent. The massive migrating herds, we believe, were chiefly responsible for maintaining, if not also creating, the vast diversity of the prairie. By more closely approximating the density (caused by predators) and migration of these herds, diversity is increasing (Report # 44: Rotational Grazier, Missouri).

These farmer-researchers recognize diversity as important and associate it directly with reduced chemical inputs. Their adoption of ecological practices that nurture diversity is contrasted with conventional systems that favor homogeneity as opposed to “mimicking” nature. A recognition of values that celebrate working in
harmony with nature, as opposed to working against it, and a personal satisfaction in
the feeling that one’s production practices are adding value to nature, as opposed to
speeding up its deterioration, is reflected in farmer-researchers’ reports. That cognition
is translated into an affirmative moment that becomes the motivator for sustaining
action and further retooling towards sustainable agriculture.

Those themes are symbolically reflected in different ways in SARE farmer
reports, suggesting that SARE farmer-researchers are not a homogenous entity even
while they may share similar values around which they ideologically frame their
actions. Moreover, the different ways SARE farmer-researchers report their
experiences suggest that there are differences among them that mediate reasons for
their participation, the experiences they have, and interpretations of those experiences.
Some SARE farmer-researchers are clearly motivated to participate in local agricultural
inquiry primarily as a means of promoting ecological practices from which they derive
personal satisfaction. This excerpt from a SARE farmer-researcher’s report is an
example.

The 73-acre ranch was purchased three years ago specifically with the
intent of developing an economically low input, environmentally

However those reports constitute a relatively small percentage of the total
number of reports used in this study. Only twelve reports reflect ecological rationales
as the only factor driving participation (Table 4.2b). Those twelve farm operations that
are adopting or shifting to alternative agriculture systems may already be financially
viable farms. In thirty-one reports, SARE farmer-researchers highlight both ecological and financial rationales as motivators of participation while only three reports mention all three sustainability reasons as motivating factors driving their participation. Some reports show that personal constraints affect motivation to participate although the constraints or barriers are not identified. This SARE farmer-researcher's report presents an example.

I chose to strip farm because it would force me toward more sustainable practices. With both small grains and legumes in your corn bean rotation you have to be very careful about herbicide carry over. It also cuts back on fertilizer use over a continuous corn system (Report # 38: Diversified Farmer, Nebraska).

Three farmers expressed their motivation for participation not from some financial or ecological considerations but from quality of life considerations. For example, the following excerpt from a farmer in Michigan shows that older farm families can be forced to shift as conditions favoring large-scale operation become unfavorable.

Since our children are grown and gone, my wife and I needed to assess and change our workload. We became interested in management intensive grazing. We hadn't done much grazing prior to this as our operation was conventional, using stored feed fed in confinement, with small exercise paddocks (Report # 32: Livestock Farmer, Michigan).

The foregoing excerpts show that farmers are not homogenous. Personal backgrounds, constraints and experiences can have important implications for farmers’
motivations to participate in programs like SARE. Illuminating such differences are critical for enhancing strategies that support the adoption of alternatives or transitions to alternative management practices that, in turn, contributes to the accumulation of experiential knowledge at the grassroots.

Social Sustainability

SARE farmer-researchers operationalize social sustainability in their reports in terms of quality of life and personal empowerment or autonomy in decision making. Quality of life emerges as a tenet underlying their motivation for participation in the SARE program. Quality of life in this context is different than objective measures of material well being, such as educational and literacy levels, personal income, and personal net worth (Seed, 1997; Flora, 1998). Quality of life emerges in SARE farmer-researcher reports as subjective rather than objective and relates to personal, family and life goals, such as time and labor flexibility. Employing those subjective terms in a textual analysis of each report in the NUD*IST application, 20.6 % of farmers' reports (see Table 4.2a) reflected concepts that relate to labor demands on family and flexibility in labor and time.

Some farmer-researchers directly link quality of life to their ability to satisfactorily “carve out” individual and family leisure time from the necessary demands of production. Some attribute lack of quality time to being locked in a conventional system that they find increasingly unprofitable.

Our current farm situation did not generate enough income to support families. Non-farm employment allowed us to continue our farming
operations but created scheduling problems in peak seasonal labor requirements. Time spent with family was almost nonexistent during spring and fall field operations. The structure of our family farm operation was also changing. My parents wished to retire and move to town, which they did. Our goal was to diversify our current farm operation by establishing a farrow to finish swine facility with attached pasture. We felt that diversifying our farm was the first step in creating a sustainable and self-sufficient operation, however, there were other family and community orientated goals we considered. We wanted a livestock enterprise that would allow us to work together as a family unit. This would increase our "family time" and give us the opportunity to teach our children responsibility. We also wanted a community (Report # 43: Diversified Livestock Farmer, Minnesota).

That value of “family time” is reiterated in some farmer reports. Spending time with their children stands out as an especially valued goal that appears to influence farmer participation in the SARE program. For some farmers, enhanced quality of life became an unanticipated bonus realized as they continued innovating along the continuum of sustainable practices. As this farmer articulates,

[O]ne of the most important benefits for our family is the reduction of labor and time. With rotational grazing, one person can feed, move animals and watering systems, and put up paddock fence with the added benefit of getting in daily walks and social time with our two young children (Report # 31: Rotational Grazier, Wisconsin).

Research focused on quality of life at the household level (Striegel, 1996; Meares, 1996) shows that the dimensions of love/respect, empowerment and family recreation time are the most important, although gender can nuance perceptions of
quality of life dimensions as well. Relational dimensions, such as respect, reciprocity and cooperative relationships with other farmers, though not often explicit in many of the reports, constitute another dimension of quality of life that some farmers acknowledge. This farmer describes that reciprocal relationship well.

Mr. and Mrs. F.O. are neighborhood dairy farmers who let us use approximately eight acres to graze young stock and dry our cows. In exchange, we provide them help as needed, especially with baling hay (Report # 15: Dairy Farmers, Wisconsin).

Empowerment is another quality of life value influencing some farmers' decision to participate, although the farmer-researchers do not mention it as often as they do other themes (five out of 68 reports). I define empowerment as a feeling that one has options and the freedom to make choices within the context of one’s self-defined sets of values. Indeed that intuitive recognition of autonomy, “being one’s own boss”, stemming from decreased dependence on external inputs is put this way by one farmer.

Through MIG (management intensive grazing) the Y center has shown a potential doubling of pasture production (like owning twice as many acres). At the same time, soils are accruing organic matter and requiring less fertilizer; watersheds are more absorbent, protecting society downstream as well as insuring the MIG practicing farmer continued production during drought. As a livestock producer, the farmer receives no costly subsidies from the government commodity programs. This saves taxpayer’s money and empowers the farmer who operates without government handouts, both worthy social impacts (Report # 4: Rotational Grazier, Trenton, Missouri).
While not directly related to sustainable agriculture, Mooney's (1988) analysis of the complex social relations that influence farm family production decisions brings out the underlying substantive rationality that often drives farmer behavior in a production system otherwise propelled by the imperatives of economic or formal rationality. That sense of independence and empowerment is keenly reflected in some reports. For those farmers, empowerment constitutes an important dimension of their perceptions of a good quality of life.

For a twelve SARE farmer-researchers, social justice is a stated value in how they perceive and interpret their agricultural production operations. Concern over the health of farm labor in a conventional system that relies excessively on chemical application is put this way by one producer: “[X] also feels better about not having to use or ask others to come in contact with the sprays” (Diversified farmer, Nebraska).

SARE Farmer-researchers' Indicators of Sustainability

Farmers who participate in the SARE program are distributed across a continuum, from a conventional system, only beginning to integrate some alternative practices on their farms, to complex and closed systems that use no external inputs. The absence of external inputs, however, can be viewed as a design-based indicator of an ecologically sustainable system. Indeed as systems become more sustainable, result-based indicators, which include changes in soil quality (soil micro fauna and micro floral populations, earthworm populations, soil structure and texture) and soil erosion rates can be used as indicators of sustainability (Ehrenfeld, 1987; Liebman and Janke, 1990). Given the limits of the evidence reported however, I employ the criterion of
sustainability that farmers actually document and substantiate in their reports. SARE farmer-researchers tended to report design-based indicators (evident in 53 reports, 77.9%) compared to result-based indicators (evident in 15 reports, 22%).

As interpretively read from their reports, most SARE farmer-researchers evaluate the sustainability of their operations in terms of their levels of reliance on external inputs or the extent to which they substitute managerial intensive strategies for external inputs. Farmer descriptions of their farms can be viewed as important design-based indicators of sustainability. How farmers perceive their farms is often symbolically reflected in the definition of their operations.

We are the heirs of a 320 acre family farm that is currently in CRP and has always been farmed on an environmentally aware basis but in a traditional manner... We obtained an early release to participate in the SARE program. Prior to the Conservation Reserve Program, the farm was actively farmed by our father who had dairy cattle, hogs and horses and did some row crop farming of corn. Our father rotated his crops and was among the first in our area to use contour farming and then to have terracing built (Report # 27: Rotational Grazier, Nebraska).

The design-based indicators of sustainability in this excerpt include crop rotations, terracing and diversified enterprise. Couched within a temporal framework these indicators also suggest that values of environmental/ecological sustainability can be passed on inter-generationally. SARE farmer-researchers' ecological characterization of their agricultural landscapes is captured even more clearly in the following farmer's report.
The X Farm consists of 320 acres. 180 owned acres, 140 are into permanent pasture with woodlot making up the remainder. Intensive rotational grazing is used to feed the 40 cow dairy herd, replacement heifers, and dairy beef which is sold to private clientele. The family has been practicing low input, biological/organic farming for the past 20 years utilizing crop rotations, manures (green and livestock), natural soil amendments - lime, soft rock phosphate, gypsum, etc. When row crops were grown, cultivation was used to control weeds. The farm is certified organic through Organic Growers of ...(Report # 56: Diversified Farmer, Michigan).

In contrast to the two above, the following report reflects how a transitioning farmer, in constructing a definition of her agricultural landscape, clearly portrays her farm as previously unsustainable but gradually experimenting with sustainable alternatives. Whereas the foregoing excerpts show several indicators of sustainability, this report reflects a previously continuous grazing system that is clearly a design-based indicator of an unsustainable agricultural system.

[It] is a family operation located one and one half miles south and one mile east of... It is a seedstock operation, raising registered Angus and Gelbvieh replacement heifers and yearling bulls. Most of the land is native grass, but there are several hundred acres that were farmed in the 1930's and reseeded to cool season grass. These areas have been overgrazed in a continuous grazing system and they currently do not produce to their capability. Prior to this grant we did not practice any sustainable practices (Report # 30: Livestock Farmer, Nebraska).
Other farmers concretely identify their operations as organic, another design-based indicator of sustainability. That design-based indicator of sustainability is illustrated in this excerpt from a Kansas farmer’s report.

We operate a 1100 acre diversified organic grain and livestock farm. Our major crops are corn, soybean, alfalfa, oats and hay, and we have a cow/calf beef herd. We certify our farm as organic through the Organic Crop Improvement Association and we market our organic crops through our marketing co-op, the Kansas Organic Producers Association (Report # 5: Certified Organic Farmer, Kansas).

Overall, thirteen reports (nearly 19%) describe SARE farmer-researchers’ operations as organic or certified organic.

**Economic Viability**

For some farmer-researchers, choice of sustainable agricultural practices is directly linked to their search for an alternative management system that can secure financial viability, as their conventional systems become more vulnerable to market forces and political economic changes. As one farmer puts it,

In a recent University of Wisconsin Extension Report dealing with the Dairy 2020 initiative, it was noted that farm commodity prices will not be on an upward trend in the years to come. In order to survive into the 21st century, dairy farmers must quickly become low cost, market oriented, and profit driven producers. There are many ways to achieve the above advice, including the adoption of rotational grazing practices and allowing young stock specialists to raise the dairy owners' animals. Why did the grant recipient consider and ultimately develop a heifer harvesting grass-legume
based feeding system for half the year? The economic efficiencies of forage production provide the answers (Report # 24: Rotational Grazier, Wisconsin).

The following example, taken from the report of a cattleman already in management intensive grazing, illustrates the underlying financial and material ethic that often drive farmers' experimentation and innovation.

With intensive grazing, I am proving that Missouri cattlemen can realize extra income and have a more sustainable livestock production by retained ownership of their calves at least through the stocker phase without buying or leasing additional pasture or cutting back on the number of cows. I am adding financial data inputs so that extension personnel or agriculture agents will have an excellent tool to teach other farmers and ranchers about the advantages of intensive grazing with cattle. This software is tailored toward cattle at this time, but could be modified for different kinds of livestock, for example sheep, in the future (Report # 64: Rotational grazier, Missouri).

Below is another example from a diversified farmer in Kansas

I wanted to see if I can develop a more diversified, sustainable crop rotation system that is more profitable than my current corn, sorghum, soybean cropping system and reduce my need for operating loans to buy fertilizer and chemicals. I needed information on what rotation options may work best for me, how they would affect my income and expenses, what other sustainable practices would be beneficial, and how I would implement these new practices while continuing to meet loan payments and other financial obligations (Report # 17: Diversified crop and livestock Farmer, Kansas).
While a farmer may be aware of the potential economic benefits of alternative practices and a desire to shift to more sustainable practices, a perceived economic barrier can prevent a farmer from attempting alternatives. That perception of financial risk can be a critical element mediating a shift towards sustainable agriculture. As this farmer puts it,

Implementing a project like this requires innovation and the willingness to put some of your land "at risk" for experimentation. A person never knows what can ultimately happen, even though everything is well planned. The advantage is that a new practice can be developed with SARE helping, thereby reducing the risk for the farmer (Report # 44: Certified Organic Farmer, Minnesota).

Institutional support provided by programs like SARE highlight the critical need to situate questions of risk at the center of sustainable agriculture practice. While the ecological importance of certain practices are implicitly addressed in some farmer-researcher reports, there is often evidence, also embedded in the texts, that suggest a time lag between that knowledge awareness and implementation of an ecological practice in a particular local context.

Family farmers, Mr. and Mrs. X, milk a herd of thirty-five Holsteins on their 150-acre farm. They raise corn for grain and silage in addition to red clover hay. The farming operation did not include sustainable agricultural practices previous to this grant. Barriers to our implementing a sustainable agriculture practice were the following: Breeding heifers on pasture without using a bull; keeping labor to a one man (sic) operation; technical knowledge and experience raising replacement heifers; financial constraints of researching a new sustainable agriculture program; financial constraints
of fully converting to a proven cost effective program... The project demonstrated the importance of rotational grazing so that we feel justified in taking the risk of the changes involved in converting the milking herd to rotational grazing. The project demonstrated how the savings that were made would enable us to make the initial investment required to convert the entire animal operation to a rotation grazing system (Report # 52: Livestock Farmer, Wisconsin).

Structural location is the social and economic position of an individual that, from a neo-Marxist perspective, can shape individual opportunity and characterize one's relationship to others in society. Eyerman and Jamison (1991) suggest that actions for change, though often concretely grounded by personal beliefs and values, can be successfully deployed only where resources are available to support that action and mitigate risks that may attend behavioral change. Those resources can be both internal to the farm, household, and community, and external to them.

Certain federal farm programs are clearly viewed by farmers as financial barriers in the transition or adoption of alternative management practices as they struggle to reconcile their commodity programs with ecological practices that they find desirable on their farm. A farmer-researcher describes that problem in the following way.

I have used some sustainable farming practices in the past, but not in a consistent way. I try to rotate soybeans with corn and milo, but the farm program has prevented me from doing so consistently (Report # 17: Diversified Farmer, Kansas).
Federal programs prior to the 1996 farm bill were barriers to the adoption of alternative practices. That in turn reduced the creation of local knowledge for sustainable agriculture as the adoption of such practices disqualified farmers from commodity payments that help to minimize the risks and uncertainties of agricultural production. In response to recent pressure from both the environmental and the sustainable agriculture movement, the 1996 farm bill included EQIP (environmental quality incentive program) and IFM (integrated farm management program) to support sustainable farmer behavior. These initiatives notwithstanding, one of the important challenges for sustainable agriculture relates to how successfully advocates mobilize public resources in the continued support of actions on farm and in the community that can enhance farmer innovation and creativity.

Overlapping Themes in SARE Farmer-researchers’ Reports

An important distinction emerging from farmer-researchers’ reports is that whilst some shifts occur as a direct result of financial vulnerability, other shifts are nuanced by a philosophical rejection of the productionist, materialist ideology of conventional agriculture. As Figure 4.1 shows, environmental and financial sustainability values overlap significantly in SARE farmer-researchers’ reports (31) as important factors nuancing participation. Quality of life concerns do not overlap to any significant extent with the other two values. For many farmers, it may be possible that social sustainability values are no less significant, but that other values located more squarely in the environmental stewardship and financial domains are of greater urgency.
Some reports do suggest that success can be evaluated within a much broader framework of values that may include but is not limited to increased profits. That multiple value orientation is articulated in the following report.

It is our goal to "FINE TUNE" our rotational grazing system, to keep our expenses at minimum, profits at maximum, protect the environment and groundwater, and share our knowledge, experiences, successes as well as failures with as many people as possible. This includes continuing to farm "organically" (Report # 45: Rotational Grazier, Wisconsin).
For others directly driven by financial vulnerability, as transitions towards alternative management practices occur, some experience growing consciousness or re-cognition of ecological relationships and social-agricultural relationships.

Without the SARE grant I would likely have gone to conventional tillage to bring my 280 acres of CRP land back into crop production. That would have increased my cost and soil erosion. I now know that I can no till hairy vetch and grow a lot of my own nitrogen and have a better seedbed... The big barrier was that I could find no one that had tried this, and there was a general feeling that nothing could compete with fescue without using a burndown. The results of no-tilling hairy vetch into my CRP grass were so dramatic that it has attracted the attention of many people. Farm Journal has taken pictures for an article. I have spoken at field days in Dixon Springs and Ewing. I have even initiated a discussion on CRP that has evolved into the Southern Illinois Task Force. The Task Force has set up five acres of plots on CRP ground in each of seven counties and have meetings scheduled. I will be on the programs discussing no tilling hairy vetch into CRP sods (Report # 8: Diversified Crop Producer, Illinois).

Klandermans (1992) suggests social action (whether collective or individual) can be both a dependent and independent variable. The social construction of meaning, as experience unfolds, can precede and become the basis for action and mobilization. Yet that action can also lead to or determine the process of meaning construction. In other words, not all farmers shift to alternative agricultural practices as a result of clearly defined stewardship or ecological values they already subscribe to, that they bring to the process of participation in the sustainable agriculture program. Rather, many shift in order to maintain their financial viability and as a rational response to a
perceived vulnerability in their system that threatens their financial base. Yet that process itself can become transformative, as personal, locally grounded experiences begin to coalesce into a new consciousness and re-orientation of values about the agriculture they practice.

Given this complex intertwining of values, the importance of defining sustainable agriculture practices broadly, not as ends, but as a continuum of practices, strategies and stock of knowledge that can contribute to the shaping of a more humane yet financially viable agriculture cannot be overemphasized. Farmers' ecological goals meld with their need to make a profit and enjoy a good quality of life.

Some SARE farmer-researchers view sustainable community relations as critical dimensions of agricultural sustainability. For example, keeping dollars within the community emerges as an important tenet of a few farmers’ values (evident in three reports). As this farmer expresses, “One thing that makes our market stand out is that my wife and I use high school boys for our work force instead of using migrants. These young men not only work in the fields but also work at sales in our market as well as deliveries” (Organic Fruit farmer, Ohio).

As research by Flora and Flora (1993) shows, increased entrepreneurial partnerships between farm and community can contribute to strong social relationships and build social capital between farm and community. The ability to forge such entrepreneurial partnerships can also be viewed as a vital edge in a changing economy increasingly reflecting a growing demand for specialized products for ever more environmentally conscious consumers. Most compelling however, from a cognitive praxis perspective, is the cognitive shift in a value orientation that celebrates the
importance of internal/local human capital and social capital resources. That orientation holds important implication for the broader social mobilization process in the agricultural and rural landscape.

Through cognitive praxis, the interlocking of values and resources clearly highlight the important implications of institutional support (including that which SARE represents) for the sustainable agriculture movement.

**Conclusion**

Farmers' philosophical value orientations and how firmly or loosely they are held at a particular historical moment appear to be related to the practices that they can or will adopt. Thus if the movement of sustainable agriculture is to be sustained, there has to be a commitment by institutional actors sympathetic to the sustainable agriculture movement to work across that continuum. Supporting and promoting the value orientation that bolsters further movement along that continuum, I argue, will be critical to successful behavioral changes in the agricultural landscape.

By providing financial incentives for on farm innovation, SARE is in fact making it profitable for farmers to do that which is moral- that is, produce farm products without compromising the health and vitality of the ecological and social system. However, while the SARE program can be viewed as an alternative government initiative to make that which is moral also profitable to do, as opposed to the conventional mindset that whatever is profitable is moral (Flora, 1998b; Buttel, 1992), it is only short term. That raises the important issue relating to the temporal dimension of sustainability. As a process, the benefits that accrue as systems move
from standard to alternative management structures do so gradually over time, indicators of which only begin to emerge after a relatively long period of investment in time and effort in instituting sustainable practices.

While the SARE Producer Grant Program is no doubt a useful initiative, the concern remains that its benefits can be severely curtailed if its support is only ensured within a short-term framework. The challenge therefore is to institute policies that can ensure long-term support for farmer innovation and experimentation with alternative practices that sustain the creation of local agricultural knowledge at the grassroots.

Creating and Transforming Alternative Agriculture Knowledge

The mix of agricultural enterprises and management practices of SARE farmer-researchers provide important insights into a dynamic cognitive process that could transform the knowledge base of agriculture in the coming decades. That cognitive process and related agri-technical activities reflected in farmers' reports stand in sharp contrast to the practices and processes that characterize conventional agricultural systems.

Conventional agriculture generally favors specialized commodity systems (whether livestock or crops), with management supported by a rich database of scientific agricultural knowledge. SARE reports show that farmer-researchers are undertaking more integrated crop-livestock management practices, mainly informed by a diversity of knowledge centers, including their own experiential locality specific knowledge.
To preface my analysis of the technical dimensions of SARE farmer local knowledge, I present a geographic profile of those farmers, including their distribution in the region, the type of agricultural enterprises and the size and scale of their agricultural enterprises. Figure 4.3. shows a distribution of SARE farmer-researchers in North Central Region.

Figure 4.3: Percent Distribution of SARE Farmer-researchers in the North Central Region-1992-1995.
The figure shows that SARE farmer-researchers are broadly represented across the North Central region with the highest number from Wisconsin. The lowest participation, based on the reports, is from the Dakotas. While there are no final reports from South Dakota, at least two applications were submitted from that state. Indeed it is significant that for both ATTRA and SARE, the lowest participation are from the Dakotas. The generally low participation from those two states can be viewed as an indirect indication of either relatively little interest in sustainable agriculture or a lack of awareness of the existence of institutions like ATTRA that support on farm shifts or transitions to alternative agriculture practices.

Another explanation may be the degree of farmer agency and activism as evidenced by the existence of a greater number of sustainable agriculture organizations in those states that had the greatest number of applications. Many of such organizations function as vehicles for raising awareness and fostering participation of their members. Indeed as documented in the Sustainable Agriculture Program Directory published in 1992 by the American Farmland Trust, Wisconsin had the highest number of sustainable agriculture farmer organizations in the North Central Region. North Dakota had only one, while South Dakota had none (American Farmland Trust, 1992).

**Size and Scale of Agricultural Operations**

In Table 4.3, I present comparative distribution of SARE farmer-researchers “operated farm acreage” as documented in their reports, and North Central regional “operated farm acreage”, computed from the 1992 Census of Agriculture. Size and scale of agricultural operations can be measured in a variety of ways. For both
conventional and management intensive rotational livestock enterprises, “average herd sizes” and “gross farm sales” are often employed to estimate size and scale of operations. Similarly, in conventional cash mono-cropping systems, “operated farm acreage” and “gross farm sales” are among frequent measures used to estimate size and scale of operations.

Table 4.3: Farm acreage of SARE Farmer-researchers Compared to the Distribution of Farm Acreage in the North Central Region

<table>
<thead>
<tr>
<th>Acreage</th>
<th>SARE Farmers</th>
<th>North Central Region</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Percent</td>
</tr>
<tr>
<td>1000+ acres</td>
<td>10</td>
<td>16.9</td>
</tr>
<tr>
<td>500-999 acres</td>
<td>5</td>
<td>8.5</td>
</tr>
<tr>
<td>180-499 acres</td>
<td>28</td>
<td>47.5</td>
</tr>
<tr>
<td>50-179 acres</td>
<td>13</td>
<td>22.0</td>
</tr>
<tr>
<td>10-49 acres</td>
<td>3</td>
<td>5.1</td>
</tr>
<tr>
<td></td>
<td>59</td>
<td>100</td>
</tr>
</tbody>
</table>

Percentages may not equal 100 due to rounding off.

In integrated systems, the use of conventional measures of size could be misleading in that different operations are systemically linked, mutually contributing to each sub-system’s viability. Thus to minimize the possibility of over-estimating the size of operations, “operated farm acreage”, which estimates the total land area for all agricultural operations on one farm, is used to present the size of agricultural
enterprises documented in the reports of SARE farmers. Forty-seven percent of farmers' reports indicate acreage ranging between 180 to 499 acres, while nearly 17% indicate average farm acreage of 1000 acres and above. Nine reports contained no information on operated acreage. The highest operated farm acreage are from North Dakota and Minnesota (5,500 and 4000 acres respectively). Those figures are consistent with national agricultural statistical records that show that farm sizes for those states are generally higher than the average for the region.

Table 4.3 indicates that a significant number of farmers with medium sized to large holdings experiment with practices deemed as sustainable within the alternative agriculture movement. It is also pertinent to note that these figures challenge conventional assumptions that associate alternative agriculture management with small-scale production. Bird, Bultena and Gardner (1995) show the complexity of the relationship between farm size and alternative management in their study in which they compared socioeconomic factors and implications of sustainable and conventional farming in the Northwestern region. Their study shows that farm size varies substantially within both farm types (alternative and conventional) and between regions, and defies any simple or linear interpretation of the relationship.

Type of Farm Enterprise

Table 4.4 shows the distribution of North Central Region SARE research farmers by type of farm enterprise. The measures shown in Table 4.4 suggest that a high percentage of SARE farmer-researchers have diversified farm enterprises, integrating crop and livestock operations or dissimilar crop types and legumes in
rotations. Nearly sixty five percent of the farmers maintain enterprises that are based on integrated crop/livestock systems. Nineteen percent of the farm enterprises are crops, mostly in rotations that include legumes such as alfalfa, and specialty crops, such as heirloom seeds.

Table 4.4: Distribution of SARE Farmer-researchers by Type of Farm Enterprise

<table>
<thead>
<tr>
<th>Enterprise type</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Livestock only</td>
<td>11</td>
<td>16.2</td>
</tr>
<tr>
<td>Crops only</td>
<td>13</td>
<td>19.1</td>
</tr>
<tr>
<td>Crops and livestock</td>
<td>44</td>
<td>64.7</td>
</tr>
</tbody>
</table>

N = 68

Livestock operations comprise sixteen percent of the farm enterprises identified. However it is important to note that there is wide variation in the definition of a livestock enterprise, from pastured animals including hogs and chickens, to management intensive rotational grazing, to confinement and semi-confinement operations where cattle and other ruminants are periodically turned out to pasture for relatively brief periods of time. While an orientation towards pasture use in livestock management can be seen as an indicator of sustainable farming, Jackson-Smith, Barham, Nevius and Klemme (1996) maintain that a distinction exists between management intensive rotational grazing and a practice they describe as “casual grazing”.

These scholars suggest that while some farmers who use large unimproved pastures as exercise lots or holding pens for conventionally managed livestock often
describe their management as grass-based, by definition, such a practice cannot be sustainable rotational grazing. This is because, they argue, the intent is not to manipulate natural systems ecologically for livestock production, but to provide temporary relief for animals from highly stressful confinement environments.

SARE farmers' enterprises are not normative features of the North Central region agricultural landscape. Farm enterprises in most of the North Central region are largely conventional cash, mono-crop rotations, or continuous confinement operations that emphasize high input and economies of scale to maximize returns to financial capital. That approach to production principally involves supplying nutrients and controlling pests by using science based strategies, which can also contribute to non-point source pollution and health problems for proximally situated rural families and communities.

Based on the "mass production model" of industrial manufacturing (Lasley, Hoiberg and Bultena, 1990; Schwarzweller and Lyson, 1995), this approach to agricultural production emphasizes the production of more of the same crops on greater land scales, while substituting agricultural technologies (fertilizers and pesticides) to control nature (pests and diseases). That control comes with high environmental and societal costs. A growing awareness of those costs has triggered grassroots activism as well as national level movements for promoting alternative agriculture and environmental protection. Concomitantly, a number of studies illuminate important causal relationships between human health, environmental integrity and agricultural chemical uses in farming (Lighthall and Roberts, 1988; Hallberg, 1987; Padgitt and Lasley, 1993). Hired labor, necessitated by scale expansion in this industrial approach
to agriculture, comprises the most vulnerable group, owing to their direct contamination from pesticides as they work in agricultural fields (Padgitt et al., 1995; Blair and White, 1985).

SARE farmer-researchers' enterprises, I argue, reflect a rejection of the industrial approach to agriculture and concretely manifest this rejection in their preference for crop and livestock diversity, substituting low impact, stabilizing ecological processes through crop rotations and innovative diversified production enterprises. While rejection is overtly manifest in eighteen reports, it is symbolically expressed in almost two-thirds (43) of the reports.

**SARE Farmer-researchers' Enterprises**

Over the last hundred years, public agricultural research and extension institutions led a process of agricultural knowledge and technology development that privileged single product management with external inputs, capitalization and concentration (Carstensen, 1960; Cochrane, 1979; Danbom, 1986). That knowledge system encompasses understanding of only a narrow range of the agricultural species and varieties, or breeds of particular species that could thrive in the U.S. land ecology.

With increasing reliance on fewer and a less heterogeneous range of productive varieties, most local and regional strains were gradually abandoned (Smith, 1992). That narrow range of crops and livestock basically characterizes the country's agricultural commodity system, which is also spatially organized (Bird, Bultena and Gardener, 1995). Agricultural commodities are based on high volume, not differentiation and quality, and in the past were sold at relatively stable and predictable
prices through a commodity market structure sustained by agricultural policies that favor large scale industrial type agriculture. Commodity production rewards volume and thus rewards farmers who produce more.

Farmer reports identify grain crops such as wheat, rye, corn, barley and oats in rotations with legumes and grasses (including native prairie grasses as well as warm season varieties from warmer ecological landscapes, such as Australia and New Zealand). Although less the case in the North Central region than observed in other regions of the country (Bird, Bultena and Gardener, 1995), crop diversity is an essential feature of systems in transition to sustainable agriculture. The inclusion of a more diverse set of alternative crop species can in effect reflect a dynamic learning process as farmers observe the outcomes of new crop-micro-environment interactions within specific and localized agroecologies. Often these practices occur in the absence of formal technical knowledge from institutional sources.

In comparison to the range of crops and livestock favored in the conventional agricultural system, SARE farmer-researchers’ enterprises reflect a more eclectic mix of agricultural products. Specialty products, which refer to agricultural products that the USDA has not categorized as commodity products and which therefore are not included in federal programs, are consistently identified among the enterprises of SARE farmer-researchers.

Since the early part of this century, some scholars have shared concerns about the growing capitalization and specialization in the agricultural commodity base. For example, James H. Hilton, the Iowa State University President in 1961, openly admonished land grant colleges to extend the sphere of agricultural research beyond its
economic and agronomic dimensions to issues that evolve around people and their
welfare (Hilton, 1961:41-42, quoted in Danbom, 1990). That concern also represents a
concrete challenge to the epistemic root of that system. That epistemic root is perceived
to be antithetical to the local and the particular contexts of agro-ecosystems in that it can
subvert the cognitive and technological contributions local players make in the
production processes that define sustainable agriculture (Kloppenburg, 1990).

Indeed, Smith (1992) maintains that as farmers adopt external agricultural inputs,
the need for management intensive practices, such as the crop rotations and integrated
livestock-crop systems for nitrogen supplies, dwindle. The loss of alternative practices
is accompanied by a loss of the potential for sustaining the related practical knowledge
accrued through practice of such techniques. SARE farmer-researchers’ production
choices and management practices offer promise of a gradual shift to alternative
ecological techniques and practices that have diminished under the pervasive
atmosphere of conventional agriculture.

The range of alternative crops, livestock and management practices of SARE
farmers suggest that they are key participants in a locally grounded micro-process that
reflects re-orientation to an agriculture that has largely been replaced in the last century
of public research and extension. Moreover, that orientation can be viewed as
rekindling a cognitive process that can, if systematically harnessed, complement the
scientific knowledge base of agriculture. This is not, however, an intent to idealize local
knowledge. Indeed the early history of American agriculture shows that some farmers'
local practices were not necessarily benign. Those practices systematically mined
fertility from the soil and led to extreme soil erosion. Sometimes close interaction with
nature and ecological processes helped, at least in the short term, to overcome the limits of their knowledge.

The critical challenge for the sustainability of agriculture is to meld appropriately and successfully different modes of cognition to support management practices that work for particular contexts and circumstances, while protecting environmental and social capital. However "scientizing" farmers' local knowledge must also be viewed as a factor in grassroots cognitive mobilization for alternative agriculture.

A Missouri farmer in the process of transition from confinement livestock production to an alternative management system on 540 rolling acres of woodland states that challenge well.

The goals of this grant were to facilitate our entry into pastured poultry and hog production, demonstrate that entry to other producers and educate consumers about different production models so that they can make more sustainable food choices. ...Patterned after Joel Salatin's model in Virginia, we built 10 X 12-foot moveable cages. These have aluminum around one half (for protection from the weather) and poultry netting around the other half. There is no floor so the chicks have the opportunity to express their natural behaviors as well as getting 20 to 30% of their feed from the pasture. Pens were moved daily. The chicks grew extremely well and were very easy to market. We grew 300 in 1994 and more than double that in 1995. In 1994 we ran the hogs in the woods, moving them every 3 to 5 days. Their pastures were made from electric netting and were roughly 40' by 40'. They did beautifully, never had an odor, gained well and had only a positive impact on the area they occupied as far as we can tell. In 1995 we ran the hogs in the lean-to of the barn on our cattle winter composted bedding. The hogs completely turned the compost thoroughly enjoying the whole exercise. Later we also allowed them into some of the corral pens where they cleaned
up the whole area. We use photos of both the chicken and hogs regularly in slide talks (Report # 39: Diversified Farmer, Missouri).

Enterprises such as poultry and swine managed on pasture do not reflect conventional practices and therefore would less likely be widely embraced as viable enterprises in U.S. agricultural systems. Yet four farmer-researchers' reports show such alternative enterprises are being tested and adopted in North Central region production systems.

SARE is not merely supporting research. In the eyes of farmer-researchers, the SARE Producer Grant Program represents a strategic risk insurance that provides a measure of financial protection as they test non-traditional innovative technologies, while shifting from a conventional technology treadmill to an alternative approach to agricultural production. As this farmer-researcher puts it,

In evaluating this program, we believe it should be more widespread and have greater funding because it provides the needed incentive for producers to switch from uneconomical practices to those that are economical and sustainable without having to take all the risk (Report # 59: Diversified Crop Farmer, Kansas).

SARE farmer-researchers' experiential "learnings" in this process reflect a source of knowledge that could be of potential significance, as increasing consumer demands and more competitive global marketing environments force more farmers towards more diversified niche production systems.

The customary practice in conventionally managed livestock production, for example, is a high use of antibiotics, which some scholars view as related to the changes
in the structure of agriculture. Boehncke (1985) maintains that as livestock production has become more specialized, with attendant increased stocking rates, incidence of diseases concomitantly increases, trapping farmers on an “antibiotic treadmill.”

Boehncke’s proffered solutions to the negative impacts of conventional systems include an orientation to animal husbandry that encompasses well-managed pasture grazing as a component of that system.

Animal husbandry, as distinct from conventional livestock management, implies an intimate connection between human agency and ecological processes that can lead to more sustainable farm production systems (Feldman and Welsh, 1995). Stewardship is central to that management system and can be the hub around which all decisions evolve. And that stewardship, while it can be manifested in different ways, always embodies practices in concert with, and has strong affinity to, nature.

Because animal confinement is the institutionally favored approach to large-scale livestock management (specifically feeder cattle, as opposed to stocker and cow-calf operations), relatively little knowledge exists in the U.S. agricultural knowledge system to support farmers looking for alternatives to confinement systems. SARE farmer-researchers’ reports suggest an interest in intensive pasture grazing among some North Central region farmers. Twenty-eight reports (41.2 percent of all reports) relate to questions about rotational and pasture management of livestock. Although that interest is reflected in the ATTRA inquiries from the North Central region, estimation of the total number of related inquiries is constrained by an overall lack of standard protocol for documenting specific subjects.
Farmer participation in alternative practices can be symbolically understood as reflecting a conscious search for an alternative technique of livestock production that expresses a farmer’s broader definition of herself in relation to her agricultural practice and its potential environmental and social impacts. As one farmer-researcher reflects,

With the help of this grant we were exposed to many different ideas and thoughts on IRG (intensive rotational grazing) and how they may be applied in our own operation. We have reached the conclusion that it is not an exact science with absolutes, but a varied system that you learn to manage by ongoing observation. The effect this has on our operation will be an ongoing observation on our financial results as well as our environmental management and our lifestyle (Report # 32: Rotational Grazer, Michigan).

Indeed, given the creative and imaginative ways SARE farmer-researchers are implementing pasture management, it can be argued that they constitute an important cognitive community and repository of new knowledge in the agricultural knowledge community.

For example, a SARE farmer-researcher in Fordyce, Nebraska finds that a simple cost-effective strategy for controlling leafy spurge in his grazing pasture in the absence of chemical sprays is to use Angora goats. After only one grazing season, he observes a significant decrease in the spurge in the grazed parches and no evidence of seed production. As that farmer details in his report, “the goats selectively consumed the spurge when offered a variety of plants.”

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Andrew H. Raedeke and J. Sanford Rikoon (1997) used the term “knowledge community to emphasize the non-bounded and overlapping nature of the different processes of creating knowledge as well as the networks of actors and processes of negotiation that are brought to bear in the process.
SARE farmer-researchers' management strategies reflect an orientation to integrate crops and livestock in a single production system (see Table 4.4). In the production systems where that diversification strategy is employed, farmers’ reports reflect a shift towards the Voisin² pasture management system. However, that system of management represents a fundamental shift away from the existing knowledge base for livestock management within the context of U.S. agriculture. Pasture based livestock management has not been a priority research agenda in the last several decades and that is reflected in the near dearth of scientific knowledge on its general principles and practices (Liebhardt, 1993).

That dearth of knowledge on rotational pasture based management systems has also meant that farmers who have adopted that alternative, by necessity, have had to engage their mental and creative potentials in their experimentation with different techniques and practices of management intensive rotational grazing.

The unique locale specific learning experiences and technical knowledge that had grown out of farmer experience with management intensive rotational grazing consistently runs through farmers’ reports. On experimenting with a watering systems model for management intensive grazing, this farmer states,

In a recent survey of Conservation Reserve Program (CRP) landowners and managers in Missouri, the most common reason given for not maintaining

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² That system of pasture management is variously described as management intensive rotational grazing (MIRG) or intensive rotational grazing (IRG) in different regions. These terms originated from grazing techniques developed by Andre Voisin who is credited with perfecting the low input pasture based system of livestock management.
CRP land in forages and bringing in livestock was lack of water. If a cost-effective water system compatible with a management intensive grazing system can be demonstrated, more of the highly erosive CRP land may be kept in forages. Our objective 1, erosion elimination, was achieved through greatly decreased livestock presence in the watering lanes (now access lanes). In the cells with the new water system, cattle no longer walk back and forth between the paddocks and one water source. Bare ground is returning to forage. We learned it is an empowering feeling to have access to water at many points on the farm. Not only does it simplify management considerations, but it also releases the imagination to explore previously impossible alternatives. (Trees, border crops, irrigation, for example). The SARE-funded project was encouraging enough for us to expand the water system over the entire farm. It has made us more of a sustainable operation, a better model and more efficient. Benefits of erosion control are just appearing. We anticipate seeing that more clearly in years to come. The economic, environmental and social impact of this practice is phenomenal. Water availability has been identified as the primary barrier to livestock production on CRP land when contracts expire. If enough CRP landholders realize the ease of installation and cost-effectiveness of water systems and MIG, many will pursue livestock rather than crop production to the benefit of their personal income, their natural resources and their local communities (Report #4: Rotational Grazier, Missouri).

The realization that, in contrast to the confinement system, the Voisin grazing management system depends on a careful and strategic manipulation of the herd and its environment to ensure maximum livestock productivity, while protecting the pasture from degradation, stands out in farmers' reports. Through their practices, farmers come to realize the complexity of the process and also gain a self-consciousness of the skills.
ingenuity and creativity they contribute to the knowledge base of that system of management. As this SARE farmer-researcher puts it,

An individual who is seriously considering the start-up of a custom heifer grazing business must deal with more than economics. Management-intensive grazing demands plenty of "brain-power" and open-mindedness. One ultimately must develop entrepreneurial, as well as observation and interpretation skills, to be successful (Report # 25: Rotational Grazier, Wisconsin).

SARE farmers' crop and livestock choices as well as management strategies reflect their roles as innovators of technologies and creators of new knowledge in agriculture. And more importantly, it illuminates the dynamic and overlapping nature of cognitive praxis. In particular it illustrates how philosophical shifts in the "ought" (values, beliefs and ethics) questions of agricultural practice can motivate technological innovation that in turn can shape the level and depth of farmer knowledge on what works for them in their particular localities.

Management Practices of SARE Farmer-researchers

SARE farmers' reports suggest that where a crop-based enterprise is the choice, the management strategy generally includes a complex crop rotation rather than a simple rotation. A carefully planned and executed crop rotation includes a sequential combination of nitrogen fixing legumes (grown not for harvest, but to serve the purpose of a green manure) with conventional cash grains, oil seeds and vegetable crops. In effect, it increases the temporal and spatial diversity of crops. Thirty-nine projects
described in farmer-researchers' reports relate to questions that clearly reflect interests in rotation regimes and crop diversity as preferred management strategies.

Those interests and values are usually reflected in the very detailed descriptions of SARE farmer-researcher farm and production enterprises. This farmer’s description of his operation presents an illustration.

The “S” family farm has been practicing low input biological/organic farming for the past twenty years utilizing crop rotations, manures (green and livestock), natural soil amendments (lime, soft rock, phosphate gypsum etc). When row crops were grown, cultivation was used to control weeds. (Report # 56: Organic Farmer, Michigan).

Another farmer presents a similar in-depth description of his enterprise.

I farm 372 tillable acres share-cropped with my uncle in Northern Illinois. Corn soybean, wheat, alfalfa, oats, and hairy vetch for seed are current crops being raised. I plan to increase spelt, sesame and two or three other high value crops to increase our rotation. Our current practices include contour planting, cover crops including vetch after wheat, rye after corn, also vetch airplane-seeded into standing soybean and soon to be tried will be seeding clover into standing corn. A good crop rotation is essential so! (Report # 68: Diversified Farmer, Illinois).

As some agronomic studies show (Altieri, 1987; Francis, 1990), systems with such rotations foster the recycling of nutrients, ensure adequate balance between organisms in the soil micro-environment, that, in turn, can ensure satisfactory organic matter buildup; rotations also suppress weed infestation and other crop specific pests above damaging economic thresholds. A good rotation system can radically reduce or
completely eliminate the need for nitrogen fertilizers and pesticides. Eliminating or extensively reducing the use of such chemicals is widely recognized as critical to the development of sustainable agricultural systems.

Such systems also contrast conventional crop rotations that typically would have two or more cash crops that may or may not include a legume (for example, a barley crop followed by wheat followed by soybean rotation). These conventional rotations have been shown to be less successful in breaking insect and weed pest cycles or meeting adequate levels of fertility to maintain profitability in the production processes (Smith, 1992; Pretty, 1994; Bentley and Andrews, 1991; Altieri, 1988) except when complemented by external inputs (mainly fertilizer and pesticides).

Satisfactorily balancing complex crop rotations (using the most appropriate alternative species) while adjusting a range of other related practices (such as estimating correct seed application rates, or the correct height of pasture grasses for grazing) demand keen powers of observation, intuition and ingenuity on the part of the farmer. That challenge can transform and extensively sharpen a farmer's "performance skills" as that experiential process unfolds through time. What is important from a cognitive praxis framework is that farmers not only come to recognize that their activities constitute a process, but also come to consciously understand that such actions can lead to important new ways of thinking and accumulating knowledge that is qualitatively different than conventional knowledge. This farmer concretely reflects that awareness.

The practice of management intensive grazing is in itself a process. Our grazing members are gradually applying it to their own farms and learning through practice. The grazing objectives and methods vary by type of
livestock species being managed (Report # 5: Minnesota Grazing Club Member).

Another farmer expresses that changing consciousness even more eloquently.

For me the most surprising aspect about the development and successful implementation of a seasonal custom heifer grazing program was that I started with very modest amounts of capital, almost no experience, and a limited cash/no debt strategy. This self imposed condition "freed" the grazier to intensively listen and study the experts’ views with an open mind. rely on low input operation (emphasizing optimal use versus output maximization), and viewing the farm operation as a long term investment ...the grazing environment and no debt finances allows the grazier the freedom to be innovative as a producer and a marketer plus it provides the farmer time to seek out future profitable strategies ...the basic infrastructure, management skills are in place, now the entrepreneurial skills must be fully employed by the grazier (Report # 25: Rotational Grazier, Wisconsin).

That agency, reflected and expressed by farmers’ direct participation in systematic practice, can be viewed as a critical indicator of a sustainable agricultural system.

To complement their crop rotation practices, SARE farmer-researchers also experiment with other alternative cultural and pest control strategies, including biological controls. For example, a diversified farmer in Illinois set out to find out the soil enriching and nitrogen fixing benefits of hairy vetch, a leguminous crop. He documents his experiences this way:
No one had experience with no-tilling hairy vetch into a heavy stand of fescue. I could only make an educated guess that it would work. And virtually no one incorporated hairy vetch or followed it with milo. The closely mowed fescue had more vetch growth early because there was less shading, but by May there was no apparent difference. The vetch was not killed, since the field is still in the CRP program. The fescue was completely killed by the vetch. The vetch could be pulled back and only a few yellow blades of fescue could be found. Research has shown 80 to 100 pounds of nitrogen available to a corn crop following vetch. The soil tilth under the vetch was much better than fescue adjacent to it. The soil was loose and moist and showed many earthworm burrows. Hairy vetch may offer a way to provide nitrogen for the next crop, improve the soil, and be an excellent material to no-till into. A plot in Wayne County has demonstrated that hairy vetch can be no-tilled into a heavy fescue sod and smother the fescue out. Hairy vetch was no-till drilled into fescue in late August at 20 pounds per acre. In 1993, there was no difference in the hairy vetch growth where the fescue was mowed extremely low or 8 to 10" high. Logic would say that mowing height could affect growth some years. No herbicides were used to burn back or kill the sod (Report # 8: Diversified Crop Farmer, Illinois).

Although conventional research shows that certain chemicals released or derived from some crops can adequately substitute for purchased herbicides, those crops, which are generally referred to as allelopathic crops, have not been a priority in U.S. breeding programs (Liebman and Janke, 1990). As farmers shift towards more sustainable agriculture, their experimentation with alternative weed management strategies place them strategically at a point where they are generating their own personal insights on allelopathic crops and how they work within their specific contexts. Although the
farmer’s immediate interest is usually couched in terms of “what works on my land?”, that personal knowledge can translate into a set of general principles as that process of experimentation uncovers consistent patterns and systemic interactions within the crop-weed and soil microbial environment.

Biological control involves the utilization of parasitic insects such as wasps, flies, mites and nematodes. Notwithstanding the rapid progress researchers have made in unraveling the complex and systemic nature of pest-environmental interactions in cropping systems, concerns persist that what systematic knowledge has been generated remain incomplete (Dlott, Altieri and Masumoto, 1994; Bentley and Andrews, 1991; Conway and McCracken, 1990). Accordingly, some researchers (among those who have recognized the value in alternative pest management systems) are beginning to acknowledge that farmers can be the best collaborators and partners because of their close interaction with the agricultural landscape.

Both farmers who implement alternative pest control strategies and experts oriented to that approach recognize that it is a knowledge-intensive process that demands keen powers of observation and creative capacities in manipulating crop-pest-predator interactions. Indeed SARE farmer-researchers’ reports concretely confirm the validity of that assertion. As an example, I excerpt the experience of a family farmer who introduced Angora goats in his pasture in order to control leafy spurge that can affect both forage productivity and quality is an example.

[M] wanted to control the spurge in his and neighboring pasture without the use of chemical sprays. [M] used Angora goats to eat the spurge before it could produce seed. The goats also consumed the plant, lessening it ability
to produce seed. This is intended to be a multi-year study, but after only one grazing season, there appears to be less spurge in the grazed patches, and no evidence of seed production. The goats selectively consumed the spurge when offered a variety of plants. When compared to a spurge patch that was sprayed by the county weed commission to provide control in the road ditch, the grazed patches showed less evidence of stems growth and no seed production. [M] thinks two more years of grazing needs to be done to get a handle on how effective goats are on leafy spurge control. The [L’s] learned that goats prefer spurge to grass. They can be grazed with cattle with no apparent loss of grass production for the cattle and help control unwanted plants at the same time. [M] is considering the use of a multi species herd for his pasture in the future (Report # 3: Diversified Livestock Farmer, Nebraska).

SARE farmers’ reports reflect a critical orientation to practical problem solving, which, in turn, can positively impact their ability to innovate as they recognize that no ready answers or techniques can be anticipated from the formal agricultural knowledge system. This observation, however, is not to negate or render trivial the mental faculties that farmers bring to bear as they experiment with and implement alternative practices situated in time and place. Farmers do not implement or experiment out of a knowledge vacuum. Rather, they utilize what objective knowledge they can tap from the conventional agricultural knowledge system as fundamental starting points. Subsequently that knowledge becomes localized, reworked and transformed as new experiences and insights unfold, culminating in what Bourdieu (1978) has referred to as praxis -- knowledge which is formed at the intersection of theory and practice. As this farmer documents.
Our numerical results on Plum Curculio (an insect larva) control mean that chickens don't eliminate Plum Curculio but still may suppress the population. On June 5th [K.J] noted that in areas where the chickens ranged when the Plum Curculio first came into the orchard the population was less than surrounding areas. From this you might surmise that the chickens are most effective when the Plum Curculio first come in the orchard and is spending time on the ground mating. When the mating process is ended and the Plum Curculios are in the trees the effectiveness of the chickens decreased. ...the daily monitoring near the trap areas and subsequent hunting in the orchard provided some excellent observations. 1) Plum Curculio will mate in the trees. 2) The majority of the Plum Curculios prefer to overwinter on a southern exposure. 3) Plum Curculio start at the bottom of the hill and move towards the top and over to the other side of the hill searching for trees with a fruit set. 4) Plum Curculio seemed to move along the edges of a drive row as they worked towards the top of the hill. 5) Plum Curculio, will be found first in trees with the earliest fruit set. 6) Plum Curculios seem attracted to the tallest trees in the row. 7) Plum Curculio will emerge from the woods based on the warming of the soil not air temperature (Report #6: Diversified Fruit farmer, Wisconsin).

Farmer experimentation is transformed by the serendipitous outcomes that can propel sustainable efforts further than anticipated. A farmer experimenting with biological controls for the Colorado potato beetle presents an example.

Our grant was for research on beetle control in potatoes. Our biggest problem growing potatoes has been the Colorado potato beetle. We used diatomaceous earth (a powder containing the skeletal remains of micro-organisms that is mined from dried lake beds). The control is caused by the beetle coming in contact with powder and the sharp skeletal remains cutting the beetles ectoplasm and the bug dehydrates and dies. This method works
best when the beetle is in the larva stage. Control of the beetles was not always satisfactory. While giving a demonstration of our free-range chickens, we were asked if we had ever used chickens to control the beetles and if we would consider trying it. We allocated a small section of our garden potatoes as a mini test and we were nicely surprised with the results. The chickens devoured nearly all the beetles in sight and did a remarkable job of weeding around the plants (Report # 62: Diversified Farmer. Michigan).

A realization that they do not only participate in creating new knowledge, but that they are also centrally involved in innovative processes emerges reflexively from SARE farmer-researchers' reports. In their attempts to shift towards alternative management practices, farmers find they need to tap their creative potentials to adapt existing technologies, such as conventional tillers and harrows, to fit their unique needs. To these farmers, it is less important that their efforts succeed than the learning that emerges as an outcome of the process. As this farmer, whose grant was used to design and build a planter capable of reliable seeding through heavy mulch, expressed in his report,

It would be an understatement to say that I am not satisfied with the outcome of this project. The effort simply has not brought us very much closer to our goal of effectively seeding vegetable crops into leguminous mulch. The goal itself, of course, is no less important for that; and I have become aware of some additional possibilities that I intend to pursue as possible. First, I think we have shown that tillers are the wrong tools for the job. The need is to create a seedbed while disturbing the mulch almost not at all. In the marketplace of ideas there is very little demand for negative results no matter how effectively they point in a more positive direction.
While I would be pleased to share what I have learned through this project, quite frankly, I can scarcely conceive of an appropriate (or even willing) audience. There are attitudes about experimentation in the sustainable agriculture community that do not readily conform to the "standard" research agenda. As an organic grower most of my work is an ongoing experiment, and I typically get results through a series of corrections over time. An engineer, on the other hand, is more likely to respond to a problem with a one shot fix, attempting to address all the dimensions of the problem with a single solution (Report # 11: Certified Organic Farmer. Indiana).

In that report, there is a conscious re-definition of that farmer as an experimenter whose results can yield knowledge, not positive or negative results. Moreover the notion of negative results as interpretively reflected in the report, challenges conventional understanding of the term which is generally associated with failure. Indeed, intuitively emerging from that report is an understanding and acceptance that “mistakes” can feature as a component of the learning process. The challenge, seen from that vantage point, then becomes how to build on past experience to ensure success in present and future practices. That mindset is reflected as a shared theme across SARE farmer reports and is often expressed within a temporal framework.

The portion containing paddocks 601, 602, 603, 604, and 605 is a permanent pasture of Kentucky bluegrass in which we frost seeded some red clover seed and birdsfoot trefoil seed in the later part of February 1995, but very little of the seed germinated. We feel the reason for that was there was not adequate seed-soil contact. There were cows pastured on this portion in 1995 by the adjacent neighbor. The portion of the pasture in paddocks 606, 607, 608, and 609 in previous years was utilized for hay and it consisted of brome grass, orchard grass, reed canary grass, alfalfa and clover. Production of hay
left something to be desired. The soil in paddock 607 was used for covering the adjacent landfill about four years ago and we have nurtured it along by seeding and applying manure, lime and commercial fertilizer. This year we applied 100# per acre of 40-30-40 on all 45 acres in April and in July 60# of nitrogen per acre on 18 acres of selected portions of the 45 acres (Report #1: Livestock Farmer, Iowa).

The notion that participation in alternative agriculture programs does not merely constitute a desire to replace or substitute conventional farm management practices and technologies with more benign alternatives is also reflexively captured. As participants move to more intensively managed systems, they not only gain substantial new knowledge and “fine-tune” their creative skills, they also develop a reflective consciousness that translates into a perception of themselves as agents of social change.

As portrayed in those reports, farmers are not passive actors. They take transformative action if and when circumstances demand. Indeed, as awareness of the environmental, financial and social consequences of their passive acquiescence to structural changes in agriculture crystallize, many farmers are mobilizing action in strategically meaningful ways at the farm and community level to take back control of their economic livelihoods and way of life. In the next section I analyze that grassroots collective action mediating the validation and exchange of local agricultural knowledge created by SARE farmer-researchers in the North Central region.
Mediating Knowledge Creation, Exchange and Action

Three organizational elements interweave the discourses of SARE farmer-researchers. These are social networks, institutional linkages, and patterns of knowledge flow. Symbolically, these elements can be viewed as implicitly connecting that community of farmers to a larger organizational framework for sustainable agriculture. For that reason, it is important to understand how these organizational ties are constituted, the meanings that SARE farmers have attached to them, and the functional relationships of those ties within the broader alternative agriculture movement. In this section, I shall discuss each organizational element and how those elements are dynamically interwoven and connected to the broader social movement of alternative agriculture.

Social Networks

Grassroots networks constitute an important dimension of sustainable/alternative agriculture. Networks can be viewed as pivotal to the identity of actors in that it is within those organizational spaces that farmers continually affirm, sustain and negotiate the common meanings that they ascribe to their practices in the broader agricultural landscape. The centrality of networks in social change and mobilization processes is widely acknowledged in the literature on social movements. Melucci (1996) for example, suggests that it is within such networks that individuals interact, influence one another and engage in negotiation as they produce the cognitive and motivational schemata necessary for action.
People do not mobilize out of a vacuum. There has to be a potential to mobilize that can be identified either as some objective precondition and/or some subjective attitudes among individuals. Within that context, networks can be viewed as important social spaces within which those elements can interact and be negotiated in order to foster action. Owing to the unstructured nature of the reports used for this analysis, no definitive conclusions can be drawn in relation to the degree of farmer embeddedness in grassroots sustainable agriculture networks in the North Central region. It is possible, however, to empirically verify, based on an interpretive "reading" of the texts and interpretation of relationships between themes, whether a farmer is linked to a network or set of social networks for sustainable agriculture within the region.

The reports show that SARE farmer-researchers widely participate in sustainable agriculture network activities in the region. About one-third of their reports (23) reflect some affiliation with a sustainable agriculture network or organization in the region. Although that participation cannot necessarily be taken as an indicator of formal membership, one can argue that their participation does reflect an orientation to, or affinity with, the broader philosophical principles defining sustainable agriculture to which those groups subscribe. That self-expressed affinity, I would argue, constitutes a socio-psychological foundation of a group identity that can be gradually amplified and transformed with sustained interpersonal interaction in farmer networks.

SARE farmer-researcher reports infer a wide array of types of relationships. Membership to established grassroots networks is explicitly documented in some reports... "as part of our involvement with the Chequamegon Organic Growers (COG), our local producers network, we were able to...." (Organic Fruit Grower, Missouri.).
Overall eighteen SARE farmer-researcher reports explicitly document membership in a sustainable agriculture or related organization. Some grassroots networks were also directly involved in "group" research activities (7 reports, 10.3 %) with the aid of SARE grants. An example is excerpted.

Our research area includes the farms of roughly 100 members of the SM grazing clubs. Currently there are a total of five neighborhood grazing clubs which meet at our neighbors’ farms throughout the year to examine members’ pastures, farming operations and discuss management methods and techniques, and network (Report #5: Rotational Graziers’ Network, Minnesota).

More commonly, networking activities are expressed in terms of personal field days held and participation in similar events on other farms.

Our field day was held on October 17 to explain and demonstrate our projects. Over 60 people attended from three states. We are on the agenda to give a slide presentation about our project at the 1994 Upper Midwest Organic Conference (Report # 6: Certified Organic Farmer, Wisconsin).

SARE farmer-researchers ascribe great importance to their grassroots networks as arenas for the cognitive valuation of their local knowledge and techniques. They perceive their social networks as important arenas for sharing and exchanging that knowledge. Indeed that is thematically reflected in all but two of the sixty-eight reports analyzed. Farmers ascribe value to their grassroots networks as social spaces of important cognitive and personal value.

On farm research and experimentation, however loose and uncontrolled, is the best form of research to impact us farmers. We find that farmers trust
other farmers much more than they trust university researchers. There is a feeling that the universities are not living in the “real world”. Whereas if a farmer can make it work, then it is worth looking into....however it certainly helps to have university folks during our presentations, because some of the issues can be supported by university research and or some technical questions can be answered by them as well...(Report # 39: Diversified Livestock Farmer, Missouri).

That farmers who have shifted from conventional agriculture to alternative agriculture find the institutionalized agricultural knowledge and extension system less useful is increasingly acknowledged in the discourse on alternative knowledge (Hassanein and Kloppenburg, 1995; Gerber, 1990). Paralleling that is the recognition that the knowledge requirements for alternative agriculture are different than the knowledge and information needs of the conventional, high input system of agriculture (Altieri, 1993; Francis, 1990). Consequently (as the farmers' reports suggest), alternative agriculturists value locality-specific and holistic knowledge, while tacitly acknowledging the need for knowledge boundaries that remain permeable to other potential sources of knowledge.

That alternative agriculture is now more favorably viewed among some mainstream science experts is tribute to how successfully its adherents have created a web of networks through which their cognitive processes and collective identity are constantly negotiated, affirmed and legitimized. Field days, pasture walks, grazing club meetings, and informal workshops are integral components of the network activities of SARE farmer-researchers. Those activities attract other farmers as well as institutional experts both within and outside the land grant complex.
Within that organizational space, cognitive exchanges are horizontally rather than vertically organized; one on one exchange is the norm rather than the exception. Science experts are viewed as partners, as opposed to being viewed as "bearers of the Holy Grail of knowledge" (Biodynamic Producer, Nebraska). The value placed on science experts' participation in knowledge sharing network activities, while at the same time conveying the perception that farmers also see themselves as real contributors to the decision making process, resonates across farmers’ reports.

The number of farmers that report hosting similar activities on their farms show that participation in those networks is widespread among SARE farmer-researchers. However, not all the farmers indicated hosting knowledge sharing and exchange activities on their farms. Four farmer-researchers failed to indicate their participation or non-participation in network activities. This may suggest that they did not host any network activities on their farms. While no clear themes emerge in the reports that provide some logical explanation or interpretation of that behavior, it nonetheless is potentially significant in that it indicates that farmers are not homogenous, and that there can be specific differences in opportunities, resources and constraints that can shape experience and outcome.

Although the scope of activities the farmers participated in presents a strong indicator of sustainable community outreach, it nevertheless has to be noted that the specific requirement for such outreach activities (that is in fact built into the invitation for proposals) introduces a potential bias. While this may limit the ability to draw any definitive conclusions, it is pertinent to note that some of the farmers are already affiliated to sustainable agriculture networks in the region, as reflected in their reports.
Some farmer-researchers view being part of an alternative knowledge network as more than an opportunity to cross-check technological innovations or establish the validity of a particular agronomic practice. They perceive social networks as spaces for fostering solidarity, building affective ties, and developing social capital. Thus, they express the reasons for their participation in terms of the opportunities that are created to meet with other farmers and build a personal community of interest.

Our interest in sustainable farming has involved us with a (hopefully) growing community of people who share our views about the importance of all of those factors to the future of agriculture...(Report # 5: Livestock Farmer, Wisconsin).

**Institutional Linkages**

Institutional linkages are important in the movement of alternative agriculture from the margins of public agricultural discourse to a social space where its cognitive identity can be recognized. Until recently, very little was known about alternative agriculture. As a result, the range of activities and issues that characterize alternative agriculture is little understood outside its small community of adherents. However, as some members of the land grant community of experts began to evaluate current agricultural knowledge and technologies in the light of their attendant environmental and social impacts, alternative agriculture garnered increased interest.

According to Gerber (1992), members of the land grant community have acknowledged the need for research and education focused on long-term agricultural sustainability and increasingly got involved in the articulation of a rationale for closer
institutional involvement and support of alternative agriculture activities at the grassroots. One result is an increased involvement of land grant experts in farmer-initiated research activities. Land grant institution involvement can be viewed as an external capital or resource base (financial, human, social) that complement the internal resources that grassroots alternative agriculture movements generate in their struggle to legitimize alternative agricultural practices.

Resource mobilization theory casts such collaborative relations within a rational instrumental logic of perceived rewards. Contrary to that theory, however, institutional involvement in the grassroots alternative agriculture process can be viewed as a manifestation of a gradual philosophical shift in agricultural values among a critical and growing community of scholars (Rochon, 1998). "Resource" in this analysis does not therefore reflect a purposive "capture" of institutional agents and experts by movement actors in order to further their mobilization ends. Rather, the term refers to the voluntary support and participation of institutional agents in grassroots actions. Institutional actors’ participation can be interpreted as a clear expression of some perceived set of shared ideals, values and goals with alternative agriculture farmers and their networks. Flora (1998c) describes this as "true capture" because it is not based on coercive or regulatory mandates, but based instead on an internalized set of ecological and social values that find resonance with a grassroots movement built on a similar set of values.

Institutional linkages play an important role in moving alternative agriculture from the periphery of agricultural discourse in a variety of creative ways. Such linkages bring a myriad of resources to the process (human, social, technical and financial) through direct support, collaboration and participation in alternative agriculture research
with farmers. Second and more significant, I would argue, are the "windows of opportunity" that such institutional linkages open up for farmers' input into larger agricultural decision making processes.

Our farm and grazing system has become well known in Michigan. At the present time I am serving on the Michigan Grazing Leadership Committee under the leadership of Dr. X. The Kellogg Foundation via the Michigan Agricultural Stewardship Association funds this committee (Report # 56: Rotational Grazier. Michigan).

Farmers recognize and express their appreciation of those institutional linkages in various ways. Some farmers see their partnerships and collaboration with agricultural scientists as a concrete legitimization of their practices and the salience of their ideas. While they acknowledge the importance of scientific knowledge for informing their practices, there is an expressed appreciation of the opportunity to verify technologies within their own holistic and more complex farm environment, through processes that are also supported and respected by institutional experts. There is an understanding that while new ideas can originate from experts, it is the personal experiential knowledge and local verification of that knowledge, which should ultimately shape the decision to adopt or adapt an innovation in their fields.

The institutional linkages between SARE farmer-researchers, the university and private sector interest groups, such as private farm consultants, appear to be less formal and hierarchically structured than in the conventional research and extension system. That research relationship between farmers and researchers is participatory rather than expert driven. The research questions addressed all emanate from specific issues and
opportunities directly related to a particular farm. The farmer initiates the questions and then often, but not always, requests expert assistance in designing a process of inquiry to test and verify sustainable alternative approaches to solving that problem on his/her farm. That approach to research, broadly categorized as participatory research, represents a radical departure from conventional research in which the expert researches and the farmer passively adopts.

Originating as a critique of the western imported technology diffusion model to developing country contexts (Rhoades and Booth, 1982; Chambers, 1993), participatory research "spoke" for democratizing the relationship between researchers and farmers. Farmers' subjective understandings of their problems and the appropriate solutions were to be just as central to designing, implementing and concluding a research project as the experts' "objective" knowledge and interpretations. Participatory research advocates see involvement not merely as problem identification/solving processes through which participants can acquire skills and construct meanings from their subjective experiences. Rather, the subjective experiences and meaning construction that flow from direct participatory processes are seen as transformative moments during which strategic insights and critical thinking can mobilize traditionally passive agents into becoming actors in social change.

Some scholars speak to the dangers inherent in the wider agricultural culture (with which institutional actors identify) that subscribes to values intrinsically different than those respected by alternative agriculture actors (Hassanein and Kloppenburg, 1995; Rikoon et al., 1996). A legitimate concern expressed within that context is that the autonomy of grassroots actors in shaping the direction of inquiry could be
undermined if institutional actors begin to take the lead in directing the process of collaborative inquiry.

However, as far as can be interpretively inferred from the SARE farmer-researcher reports, institutional actors in these collaborative processes maintain a very flexible relationship, respectful of farmers' autonomy in identifying the research problem and shaping the process of collaboration. In Table 4.5, I delineate the patterns of partnerships reflected in SARE farmer-researcher reports and indicate their distribution across the reports used in the study.

Table 4.5: Patterns of Participation for SARE Farmer-researchers and Institutional Partners

<table>
<thead>
<tr>
<th>Patterns of Participation</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmer initiates research, identifies problem; close collaboration with researcher in research design, experimentation, data collection and analysis; farmer and researcher disseminate results.</td>
<td>34</td>
<td>50.0</td>
</tr>
<tr>
<td>Farmer initiates research; designs experimentation, collects and analyzes data; researcher in advisory and mentoring capacity; farmer disseminates results.</td>
<td>27</td>
<td>39.7</td>
</tr>
<tr>
<td>Farmer networks initiate research; close collaboration with researchers, extension agents and other interested parties such as agencies and crop consultants for experimentation and results dissemination.</td>
<td>5</td>
<td>7.3</td>
</tr>
<tr>
<td>Farmer initiates research, experiments, interprets data and disseminates results; no evidence of partnerships with any institutional entity.</td>
<td>2</td>
<td>2.9</td>
</tr>
</tbody>
</table>

N = 68
Those patterns of partnerships between science experts and farmers, including their grassroots networks, appear less often as conduits for knowledge transfer than as intellectual/cognitive spaces for selectively melding knowledge from multiple arenas to fit specific contexts and special needs. While an understanding that objective knowledge can be important emerges as rhetorically significant, many SARE farmer-researchers also actively foster ties with conventional institutional sources of agricultural knowledge.

As the table shows, farmers play critical roles in delineating the questions of cognitive importance. In the four models of participatory collaboration described in their reports, farmers identify and define what is of research interest, which invariably reflects substantive problems relating to their locale-specific agricultural practices. University researcher involvement in project design, experimentation and analysis is evident in fifty percent of the reports. Researchers also participate actively in a mentoring and advisory capacity in an additional forty percent of the research projects.

A number of important questions emerge in this context of scientist-farmer collaboration: how does standard agricultural research (the scientific experimental approach) and participatory farmer research fit together? Is there a relationship between the type of research conducted in SARE farmer-researchers' contexts, and the patterns of participation between farmers and institutional partners? Is length of time in sustainable farming a factor in determining these relationships? In responding to these questions, I did a cross tabulation of the patterns of participation between SARE farmer-researchers and institutional actors, type of research and years in sustainable farming as indicated in their reports. I present the results in Table 4.6.
Table 4.6: Results of Cross-tabulation of Type of Participation, Type of Research and Years in Sustainable Farming

<table>
<thead>
<tr>
<th>Type of Participation</th>
<th>Type of Research</th>
<th>Category by Years in Sustainable Farming</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Beginning Farmers</td>
<td>Transitioning Farmers</td>
</tr>
<tr>
<td>Farmer only</td>
<td>Non-Standard Research</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>Farmer/ Researcher</td>
<td>Standard Research</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Non-standard Research</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>15</td>
<td>6</td>
</tr>
</tbody>
</table>

Agronomic studies show that it takes an average of three to five years to replace a totally conventional rotation (augmented by pesticides and fertilizers) to rotations based on manipulation of natural ecological processes such as use of organic manure and nitrogen fixing crops (Andrews, Peters and Janke. 1990; Bird, Bultena and Gardner, 1995).

Accordingly, I grouped farmers into four categories based on the number of years farmers state they have experimented with sustainable agriculture practices. Those farmers who have experimented with sustainable practices for 1-2 years, I categorized as “beginning farmers”, 3-5 years as “transitioning farmers”, 6-8 years as “intermediate farmers, and 9 years and above as “long timers.

I categorized the types of participation between farmers and institutional researchers into two categories, “farmer-researcher” and “farmer only”. Reports that
did not have information on any of the relevant variables were treated as missing data. Fifteen reports were consequently eliminated because they lacked either one or more of the variables. A total of fifty-three reports were coded and analyzed.

I broadly categorized the type of research approach (described in each report) as either standard research or non-standard research. Standard research in this context refers to the scientific experimental method including the complete random or split plot experimental designs. Non standard research broadly refers to the diverse patterns of local inquiry based mainly on farmers’ creativity and insight rather than on formal patterns of conducting scientific research.

The table shows that “long timers” (24) who participate with researchers also tend to employ the standard research approach. However, the table also indicates that participation with researchers, and employing non standard research strategies are not necessarily mutually exclusive. Eleven SARE farmer-researchers whose descriptions of their farms reflect non-standard approaches did participate with researchers. The figures suggest also that SARE farmer-researchers who have been in sustainable agriculture practices longer are more likely to have collaborative relations with institutional agents and would tend to employ standard approaches to their on-farm research.

My interpretive analysis of these participatory relationships and types of research indicate interesting overlaps that may suggest that within the context of local farmer inquiry the traditionally rigid boundaries between standard scientific research and non standard (putatively non-scientific) research may be getting more permeable. Standard scientific research results are complemented by other results based on
farmers' keen powers of observation, intuition and creativity as they experiment in their own specific locales.

Indeed while the standard scientific approach retains its institutionalized hegemony as evidenced in the context of SARE farmer-scientist collaboration, creative avenues and cognitive spaces are being expanded to forge alternative approaches where new ways of thinking dialectically mesh with conventional research and knowledge.

**Knowledge Flows among Alternative Farmers in the North Central Region**

SARE farmer-researchers' reports show that cognitive practices are social. They show that the flow of knowledge from its local contexts of creation also involve important processes of social interaction, negotiation and mediation. SARE farmer-researchers' descriptions of their activities suggest they do not view knowledge as a commodity owned by one entity, to be transferred at a certain cost to another entity. Table 4.7 delineates SARE farmer-researchers' avenues for sharing and exchanging knowledge, as well as disseminating the experiences and results of their personal knowledge.

The knowledge flow processes farmers describe mirror a continuity of cooperative activities characterized by mutual learning primarily among farmers, while extending the boundaries of flow to embrace the wider community of interests in sustainable agriculture. Much of the knowledge created through farmer-led processes of inquiry flow through direct informal exchanges that occur during field days, pasture walks and farmer workshops or through newsletters and published monographs of sustainable agriculture organizations.
Table 4.7: SARE Farmer-researchers Avenues for Sharing and Exchanging Knowledge.

<table>
<thead>
<tr>
<th>Avenues of Communication</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmers who shared and exchanged knowledge</td>
<td>56</td>
</tr>
<tr>
<td>Newsletters</td>
<td>18</td>
</tr>
<tr>
<td>Workshops</td>
<td>11</td>
</tr>
<tr>
<td>Field days/pasture walks</td>
<td>25</td>
</tr>
<tr>
<td>Community Newspapers</td>
<td>9</td>
</tr>
<tr>
<td>Professional Journals</td>
<td>1</td>
</tr>
<tr>
<td>Published Monographs</td>
<td>6</td>
</tr>
<tr>
<td>Farmers who did not share and exchange knowledge</td>
<td>12</td>
</tr>
</tbody>
</table>

The number of farmers who organized and participated in those activities on their farms is evidence that farmers value this mode of exchange. Fifty-six SARE farmer-researchers identify in their reports one or more of the avenues delineated in Table 4.7 as a source of communication and interchange of knowledge. The avenues are not mutually exclusive however and in some cases, farmers listed multiple outlets for sharing and exchanging their experiential knowledge.

Field days are the most common, with twenty-five SARE farmer-researchers indicating holding one or more field days during the tenure of their respective grant programs. An instructive insight farmers interpretively infer in their reports is that the...
processes of knowledge flows, like the inquiry process itself, can be participatory.

Farmers describe researchers' and extension personnel as pivotal to the success of farmers' field based social and communicative events. As partners, university researchers are also described as centrally involved in the dialogue on emergent insights from the inquiry, answering questions and complementing farmer responses to questions from participants. As this farmer recalls,

We held one field day and one pasture walk. Over one hundred people, three implement dealers and resource people attended the field day from MSU. Fifteen people attended the pasture walk with Dr. M. from MSU sharing his expertise as they walked the paddocks at both farms. Both these events were featured in our local newspapers (Report # 29: Rotational Grazier, Michigan).

Because all participants are involved in interpreting and sharing research findings, this process can be viewed as democratic. Participants not only enjoy the autonomy of "seeing" through the lenses of their own personal experiences, but they are also empowered by the recognition that they can be teachers as well as learners.

Moreover, through agricultural scientists' direct participation, knowledge that might ordinarily have been dismissed as local and idiosyncratic becomes synthesized, shared, and evaluated through more formal processes such as scientific journals and published monographs, usually the exclusive domain of scientific agricultural knowledge. At the same time, knowledge that is generally reported only in local newsletters and popular media sources is moving to wider arenas of access, making that
knowledge more accessible and understandable to a wider community of interest. As this report portrays.

In October which is Pork Month, I was contacted by “The Land”, a regional newspaper, for another article. This complete issue was dedicated exclusively to the hog industry. This article prompted a five-radio interview on KDUZ based out in Hutchinson, Minnesota, during their morning farm show. The most recent event at which we publicized our information was the North American Symposium of the AFSR/E, “Linkages among Farming Systems and Communities”, on November 5-8, 1995, when MH and myself did a poster session and took part in a panel discussion entitled, “Importing a Sustainable and Animal Friendly Pig Production Model from Sweden” (Report # 43: Livestock Producer, Minnesota).

In conventional agriculture systems, knowledge is created through a scientific research process, guided by the norms of scientific practice and validated through processes of peer review at professional conferences and journal submissions. Such scientifically validated knowledge can then be compiled for dissemination through public and private extension sources to farmers who then employ that scientific knowledge for agricultural production decisions. This flow process has historically been only one way.

In contrast, the process by which farmers' knowledge flows from its local context of creation can be viewed as iterative and dialectical. In addition to the more formally organized social avenues for exchange of knowledge already discussed (farm walks, field days, workshops), farmers are sharing and exchanging knowledge and skills across fences as well.
The other people involved in this project were DR, a neighbor who is an agricultural engineer at Purdue, and BX, another neighbor who farmed for many years and was most generous with his time and mechanical skill in the latter stages of the project (Report # 11: Certified Organic Farmer, Indiana).

Another SARE farmer-researcher recalls,

I was assisted in this project by PB of Badgerset research farm who developed the hybrid hazelnuts, and by TF, a neighboring farmer who had planted them a year before. They both shared their knowledge on how I can design, plant and proceed on this project (Report # 18: Diversified Crop and Livestock Farmer, Iowa). That reciprocal relationship, echoed in farmers' reports, stand in sharp contrast to images that idealize the rationality of competition over cooperation between farmers.

Alternative farmers' processes of knowledge flows are characterized by a dynamic interplay of heterogeneous and overlapping networks for synthesizing and disseminating information. That complexity is similarly evident in conventional agricultural information flows, when chemical companies, corporate advertising agencies and independent crop consultants increasingly vie with public institutional agencies in the dissemination of agricultural information. In contrast to that conventional system that is often hierarchically organized, the alternative system of knowledge flows is characterized by horizontal relationships based on mutuality and reciprocity. In this flow process, knowledge is treated less as a technology package transfer than as a circular process of co-learning and teaching that can involve multiple sources and agencies of information.
Alternative information transfer agencies are critical intermediaries and institutional resources in that they not only connect grassroots farmers to diverse sources of alternative information on questions specific to their alternative enterprises or management concerns, but also facilitate indirect links to scientific knowledge that can address more general agronomic questions.

That critical role is illustrated by the degree of complementarity and overlap I find between SARE farmer-researchers’ knowledge-related interests and the knowledge related inquiries of farmers in the North Central region to ATTRA. In the next section, I link the findings from that analysis to the broader insights that emerge from my interpretive “reading” of SARE farmer-researcher reports.

Collective Action and Institutional Support: Sustaining the Movement for Alternative Agriculture in the North Central Region

As the movement for sustainable agriculture gains prominence in the rural landscape, what has conventionally been understood as a democratic agricultural knowledge process has become a problematic around which groups interested in sustainable agriculture at both grassroots and institutional levels organize. That agency, the ability of an individual or group to self consciously act towards promoting a favored social order or against an existing social reality perceived to be working against their welfare and interests, is reflected in the actions of SARE farmer-researchers.

SARE farmer-researchers’ conscious search for a cognitive base (which reflects the web of agricultural and community values that sustainable agriculturists subscribe to) illustrates a fundamental challenging of a dominant agricultural knowledge code in
the U.S. agriculture landscape. Farmers' knowledge interests indicated by their reports, reflect less a concern for what is considered scientific by mainstream actors than for technology that can concretely work on their farms, within the context of their values.

However, while local experience and innovation is crucial at the everyday level of the farm, an alternative agricultural information institution like ATTRA also plays important functions as a complementary repository of knowledge. Alternative agricultural information transfer centers can be critical institutions mediating farmer ability to shift from standard to alternative systems as the risks of unavailable technical information to support on farm behavior is obviated.

The cognitive actions exhibited by both SARE farmers, and less directly by ATTRA clients, strategically portray those individuals as active information seekers and processors of knowledge. Programs like the SARE Producer Grants, and ATTRA can be viewed as both material and ideological institutional support for transformative social change at the grassroots.

Institutional support relates to policies and actions that sustain and enhance direct linkages between grassroots actors and multiple centers of knowledge traditionally accessible only by institutional agents. It includes emergent alternative agricultural knowledge centers, such as ATTRA. Rochon (1998) argues that the potential for positive cultural change only begins to become potent when it is coupled with institutional niches that nurture agentive behavior (such as that which SARE farmer-researchers and ATTRA clients exhibit through their knowledge related activities).

The relationship between farmers’ knowledge-related activities and supportive institutional niches similarly underscores theoretical positions by social movement
scholars like Eyerman and Jamison (1991b) and Ferree and Miller (1985), who maintain that success in a social movement constitutes the product of a dialectical relationship between agency and structure. Within this context, one of the critical challenges for the sustainable agriculture movement relates to how successful institutionally based activists in universities and centers of policy making can sustain the mobilization of critical resources that are so pivotal in promoting and enhancing grassroots actions for social change.

The knowledge interests reflected in the inquiries and matching responses in the ATTRA data, and the participation of farmers in the SARE program suggest that there is interest in sustainable agriculture knowledge among some agriculturists in the North Central region. While the ATTRA knowledge inquiry inventory is not conclusive, given the limitations that hindered a more in-depth and critical analysis, it does show however that there is congruence in the knowledge interests reflected between the SARE farmer-researcher knowledge reports and the ATTRA inquiries. The knowledge interests reflected in both sources of data suggest that North Central region agricultural actors may share a similar desire to learn about alternative management practices, and that they can act towards realizing that goal. Based on the interpretive evidence emerging from my analysis, the cognitive activities and practices of grassroots actors can, with the proper institutional resources, gradually transform agriculture in ways that sustain farm, environment and community.
CHAPTER V

SUMMARY AND CONCLUSIONS

Introduction

This study is predicated on two premises:

1) That alternative agriculture information centers play critical roles in the promotion of sustainable agriculture by linking agricultural activists seeking alternative knowledge to a broader and more democratic base of agricultural knowledge. To verify that premise, the research employs a keyword strategy to inventory the knowledge-related inquiries and matching responses of ATTRA clients in the North Central region. Congruence between the inquiries and the knowledge SARE farmer-researchers generate is an important indicator of responsiveness to the felt knowledge requirements of farmers in the region.

2) That SARE farmer-researchers in the North Central region are part of a grassroots social movement for sustainable agriculture in the U.S. Stemming from that premise is an interest to illustrate the cognitive contributions of farmers experimenting with or implementing alternative enterprises and whole systems management strategies. Rather than taking that cognitive factor as implicit and therefore "given", this study examines those social actors' cognitive processes as the central dynamic of collective action and mobilization.

The research adapts Eyerman and Jamison's (1991) model of cognitive praxis to ground analysis of SARE-funded farmers as creators of critical knowledge in the U.S.
agricultural landscape. Cognitive praxis, itself concretely embedded in a sociology of knowledge perspective, posits a view of knowledge as pluralistic, multi-faceted and complex. Because, as Eyerman and Jamison had argued, that process is often collective, it can also be viewed as social.

By conceptually delineating the plurality of knowledge, cognitive praxis offers an approach to re-orienting attention to grassroots actors involved in the creation of knowledge. While acknowledging the possibilities of scientific knowledge, cognitive praxis ascribes similar credence to the potentialities of alternative knowledge. Yet that conceptualization, while privileging the importance of agency in mobilizing for social change, also acknowledges the significance of mediating structural contexts in determining or shaping the outcomes of collective action.

The loci of attention in this research, delineated in Figure 3.1, are the dynamically interwoven dimensions of actors' philosophical values, processes of creative technological innovations, and the social organizational framework bounding those processes. In the rest of the chapter, I present the interpretive summary of my analysis of the dimensions delineated, and conclusions drawn from the results of study.

**Value Dimensions of Alternative Agriculturists' Local Knowledge and Practice**

SARE farmers' cognitive praxis shows how ideological precepts about stewardship, social justice and human relationships with nature are related to creativity. Farmers are creating and disseminating critical new knowledge. However, that creative process is firmly guided and shaped by underlying ideological worldviews about their ecological and social environments. The processes are integrally linked. While the
imperatives of financial and material sustainability clearly underpin initial shifts towards alternative management practices, SARE farmer-researchers’ interpretive accounts suggest that they are also concerned about the quality and perpetuity of our environmental capitals -- water quality, soil quality and ecological diversity. Equitable human relationships and quality of life values similarly permeate, though with less intensity, farmer decisions to engage in on farm experimentation and alternative agricultural practices.

That values that guide SARE farmer-researchers challenge the common conception of western farmers as solely economically rational actors, driven only by the imperatives of maximizing as opposed to optimizing returns. No doubt, the generalizability of findings from this study may be limited by the regional specificity and relatively small number of farmers' reports analyzed. Nonetheless, an important implication that emanates from the evidence is that there may now be greater space in the agricultural landscape for an alternative approach to agricultural production to expand than has been hitherto realized.

For alternative approaches to influence cognitive changes on farm, however, system wide changes are required that can support individual innovation and creativity. One of the critical challenges in 21st century agriculture is how public institutions can effectively support changing and emergent values among farmers to sustain that innovative and creative synergy at the farm level.

ATTRA’s knowledge related inquiries, based on the keyword search, and my interpretive analysis of the elements embedded in the inquiries similarly reflect a clear orientation to environmental and stewardship values. Given the consistency of those
values across the set of inquiries used in the study, it can be concluded that ATTRA is a critical link to the kinds of knowledge alternative farmers seek: knowledge undergirded by values that protect their environmental as well as social capitals.

**Local Knowledge Production as Cognitive Process: The Technical and Managerial Dimensions**

Interpretive analyses of SARE farmer research reports show that their experimental practices, bounded as they are within local and specific agro-ecological domains, reflect a conscious process of creating and discovering novel ecological and technical agricultural knowledge that is of personal and immediate relevance to their farming contexts. SARE farmer-researchers challenge a knowledge base they find less in resonance with their changing philosophical values. Thus, their cognitive activities in search of what “works” in their specific locales emerge as a critical factor in mobilizing collective action for sustainable agriculture at the grassroots.

Moreover, it also shows that farmers embedded in their specific locales can be involved in innovation which is personal and contextual, but nevertheless systematic and therefore scientific. Alternatives to mainstream agricultural practice can be developed, tested, evaluated and validated within holistic, and therefore more realistic, agricultural environs. Farmers’ reports show a keen recognition that while local knowledge can be intrinsically valuable knowledge, it can also be complementary to the kind of knowledge that Kloppenburg (1990), following Latour (1986), describe as mobile immutables. New sociology of knowledge theory posits that while knowledge can be created through deductive processes of reasoning, critical understanding can also come from the practical
knowledge of everyday experiences, grounded in local contexts and shaped by the particular cultural environment in which an actor is embedded.

SARE Farmer-researchers' processes of creating knowledge concretely illustrate how both types of knowledge, selectively and creatively melded, can support sustainable outcomes on farm as well as in community. The technical and experiential knowledge generated through their research provides empirical support for the major theoretical thrust of the new sociology of knowledge perspective - that knowledge is pluralistic and multi-faceted. SARE farmer-researchers' inquiries show that sustainable agriculture actors neither reject the possibility of conventional scientific agricultural knowledge nor reify local knowledge. Rather, they continue to learn, through their local and situation specific experimentation, the most effective approaches to selectively combining diverse kinds of agricultural knowledge in ways that work for them both philosophically and pragmatically.

The ATTRA inquiries examined in this study reflect a similar pluralistic orientation to agricultural knowledge. Indeed while the keyword search results show that there is interest among the agricultural community in alternative technologies and management strategies, interests that relate to general scientific principles also interweave sustainability inquiries.

Two implications stand out from this analysis, and both imply careful reflection for sustainable agriculture policy and action. The first implication is that the conceptual distinction so pervasively evident in mainstream western discourse between scientific knowledge and local knowledge may be less distinct within the context of sustainable agriculture. By building on, or adapting, what is generally recognized as conventional
knowledge and technology, alternative agriculturists' innovative and experimental practices show that the whole spectrum of agricultural knowledge can be seen as a continuum, rather than as diametrically divergent modes of cognition. This offers enhanced possibilities for strategic research and collaboration between agricultural scientists and grassroots agricultural actors, provided institutional support also expands in response.

A second implication, which emerges more directly from SARE farmer-researchers cognitive activities, is that the relationship between knowledge and technology is dialectical rather than unilinear. Out of the need to find our what “works” - a new practice, or an adapted technology - new cognitive insights emerge that are internalized and transformed to knowledge. That knowledge can also be the basis for further innovation. Herein lies the dialectic. That process is no different for scientific knowledge and technology (Bell, 1996; Warner and England, 1996). What is important is that that dialectical process speaks to the need for supporting grassroots innovative practices as a concrete approach to expanding the sustainable agriculture knowledge base and ultimately contributing to the broader process of social change in agriculture at the grassroots.

The technological dimensions of SARE farmers' cognitive practice show that ecological diversity is central to systems that are moving towards sustainability. Diversity invites an appreciation of the multidimensionality of natural processes. SARE farmers' interpretive accounts show that crops and livestock are not necessarily conceptualized purely within an economic dimension. Rather, they are seen as part of a much wider mosaic of natural processes. Moreover, the reports reflect how knowledge
produced within such systems can be uniquely located in particular circumstances and places.

Socializing Local Agricultural Knowledge and Mobilizing for Change at the Grassroots

The social organization process through which farmer-generated knowledge is verified and codified consists of horizontal, rather than vertical forms of organizing. That social organizational context emerges as an arena for celebrating a shared identity, as challengers of a dominant agricultural ideology and purveyors of an alternative ideology. SARE farmer-researchers' and ATTRA clients' collective and manifest interests in alternative knowledge, and their active search for that knowledge gives them a collective identity that characterizes them as social movement actors. The inventory and analysis of ATTRA's knowledge-related inquiries from the North Central region suggest it not only plays an important role in supporting grassroots actions towards the adoption of alternative agriculture practices, but that it can also be viewed as a key institution mediating grassroots transitions to sustainable agriculture. Moreover, the inventory suggests that the knowledge requirements of ATTRA clients could be useful for informing research of direct relevance to the alternative farmer.

SARE Farmer-researchers' behavior clearly bears out Wainwright's (1994) theoretical argument, which explicitly places social mobilization at the intersection of practical knowledge and agency. Farmers' search for an alternative knowledge base emerges in this study as a foundation for resisting the conventional knowledge system, and as a basis for social action.
Their reports show that the process of knowledge creation and sharing for sustainable agriculture can be democratic as well. One element that stands out from my interpretive mapping of SARE farmers' cognitive praxis is the interpersonal nature of the grassroots social organizational process for sharing and exchanging knowledge. In contrast, knowledge creation and exchange in the conventional agricultural knowledge system, closely guarded by a set of narrowly defined criteria grounded in the rules of positivist philosophy, effectively excludes most grassroots knowledge creators from that process of exchange and sharing.

The social organizational framework through which SARE farmer-researchers create and share alternative agriculture knowledge engenders a different kind of relationship between institutional agents and local actors. The inquiry process engages participants as active agents, mutually collaborating towards a clearly defined end, specific to place and context. Participation is at the core of that relationship.

That approach to knowledge creation and sharing is clearly instructive, particularly within an agricultural landscape that is rapidly changing in both economic and social complexity. Current devolution processes occurring in the overarching global political economy are leading to increased segmentation of local actors. Moreover, growing consumer demands for specialty products grown under environmentally safe conditions and shaped by socially responsible relationships can lead to greater diversity in production enterprises located in strategic niches.

This poses a challenge to the land grant institutions. In the last few decades such institutions have come under much criticism from scholars and activists who charge that their historic public mission has been subverted by corporate agriculture. According to
those critics, much of the research supported at land grant colleges is overwhelming oriented to meet the knowledge interests of large and highly capitalized farms, rather than the broad spectrum of agricultural actors in the landscape (Lacy, 1996; Busch, 1994; Kloppenburg, 1991). For sustainable agriculture to survive and prosper in the agricultural system, there must be a reorientation of institutional support through research and extension that responds to the knowledge interests of alternative farmers as well.

The cognitive praxis of SARE farmer-researchers point to a useful direction for restructuring the research and extension system in order to support a much broader based system of agricultural knowledge. It suggests the essential building blocks for a more democratic process of knowledge flow that can be of service to all agricultural constituents irrespective of social location. Cognitive praxis also reflects a process where farmer knowledge and scientific knowledge can be in dynamic interaction, constantly shaped by emergent insights obtained through concrete practice in local contexts. Such praxis will ultimately produce a more inclusive web of knowledge for an agriculture that sustains land and community.

Sustainable agriculture has attracted widespread attention among policy makers as well as intellectuals in recent years. But concepts alone, as Wainwright (1994) has maintained, cannot achieve institutional change. The success of sustainable agriculture rests as much on the collective mobilization of its actors as it does on the institutional legitimacy that it can enjoy, if the boundaries of its knowledge base can meld in meaningful ways with that of the conventional knowledge creation system.

The challenge in that process lies in, a) developing a democratic framework of participation that acknowledge the cognitive potentials that situated actors can possess.
and b) devising approaches for tapping that potential without subverting the autonomy of its creators. As Ferree and Miller (1985) maintain, success in a social movement constitutes the product of a dialectical relationship between agency and structure. Institutional activists have a critical responsibility to influence the structural factors that can mediate grassroots mobilization for social change in the agricultural landscape.

Conclusion

This research demonstrates that one of the critical challenges of sustainable agriculture policy is to translate the economic, environmental and social values that guide farmers who are committed to agriculture into operational strategies that can further reinforce those values. SARE farmer-researchers and ATTRA clients search for new knowledge reflect a strategic thrust that has the potential for sustaining the movement of a much broader set of farmers towards the adoption of alternative practices. Approaching sustainable agriculture from that perspective illuminates a process by which resources and individual motivations can crystallize into actions that support that process over the long term. Because the concept of sustainable agriculture is complex and diffuse in its interpretation, it is more useful to view it as a process, rather than as an end in itself.

As such, its myriad practices must be seen as points along a continuum rather than as an ordered set of practices to be uncritically adopted, irrespective of specificity and circumstance. This study shows that there is a keen need for federally supported programs like the SARE Producer Program and the ATTRA program, which can support the gradual movement of farmers along that sustainability continuum. Both programs can be viewed as models for emulation. What this research leads me to conclude is that
well designed government programs that support "bottom up" research approaches for
knowledge creation and technology development can contribute significantly to the
adoption of sustainable practices.

My interpretive reading of SARE farmer-researchers' reports leads to the
conclusion that farmers can creatively develop, evaluate and implement what works for
them within the context of the ecological and social principles that guide their
relationships to place and community. This agentive potential clearly shows that the
structural transformation occurring in agriculture and the inequitable distribution of
power that often attend structural change, is not some inevitable process, impervious to
human reaction.

Actions of individuals and groups within strategic social spaces and localities can
trigger change processes that can lead to social, environmental and economic
sustainability. The local cognitive process, as SARE farmer-researchers' activities show,
constitutes one such critical space. The continuing sociological challenge is to continue
expanding understanding of the elements, structure and processes that characterize that
space in order to tap its potentials for sustainable agriculture.
APPENDIX A

KEYWORD SEARCH PROTOCOL FOR CLIENTS’ MATCHING INQUIRY-RESPONSES

<table>
<thead>
<tr>
<th>Integrated Pest Management</th>
<th>Small scale producer</th>
<th>Decomposition</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPM</td>
<td>Transitioning farmer</td>
<td>Living mulch</td>
</tr>
<tr>
<td>Pasture management</td>
<td>Polyculture</td>
<td>Non-chemical control</td>
</tr>
<tr>
<td>Rotational grazing</td>
<td>Soil amendments</td>
<td>Alternative</td>
</tr>
<tr>
<td>Intensive grazing</td>
<td>Natural production</td>
<td>-production</td>
</tr>
<tr>
<td>Grass-based production</td>
<td>Direct marketing</td>
<td>-pest control</td>
</tr>
<tr>
<td>Pastured livestock</td>
<td>Community supported-</td>
<td>-management</td>
</tr>
<tr>
<td>Pastured chicken</td>
<td>agriculture</td>
<td>-livestock management</td>
</tr>
<tr>
<td>Pastured hog</td>
<td>Farmers markets</td>
<td>-crop management</td>
</tr>
<tr>
<td>Diversified</td>
<td>Marketing organic</td>
<td>-pesticides</td>
</tr>
<tr>
<td>Diversification</td>
<td>Niche marketing</td>
<td>Ecology</td>
</tr>
<tr>
<td>Integrated production</td>
<td>Sustainable; sus; sust.</td>
<td>Ecological</td>
</tr>
<tr>
<td>Inter-cropping</td>
<td>-farmer</td>
<td>Biodynamic</td>
</tr>
<tr>
<td>Cover crops</td>
<td>-producer</td>
<td>Biodiversified</td>
</tr>
<tr>
<td>Specialty</td>
<td>-agriculture</td>
<td>Beneficial insects</td>
</tr>
<tr>
<td>-Herb production</td>
<td>-hydroponics</td>
<td>Holistic</td>
</tr>
<tr>
<td>-Vegetable production</td>
<td>Organic ; org</td>
<td>Mulch (ing)</td>
</tr>
<tr>
<td>-Livestock production</td>
<td>-producer</td>
<td>Humus</td>
</tr>
<tr>
<td>Biological control</td>
<td>-farmer</td>
<td>Humate</td>
</tr>
<tr>
<td>Bio-control</td>
<td>-farming</td>
<td>Compost (ing)</td>
</tr>
<tr>
<td>Bio-intensive</td>
<td>-fertilizer</td>
<td>Low input production</td>
</tr>
<tr>
<td>Biological fertility</td>
<td>-livestock</td>
<td>Earthworms</td>
</tr>
<tr>
<td>Crop rotation (s)</td>
<td>-crops</td>
<td>Biodiversity</td>
</tr>
<tr>
<td>Rotation (s)</td>
<td>-fruit</td>
<td>Legumes</td>
</tr>
<tr>
<td>Green manure</td>
<td>-vegetables</td>
<td>Nitrogen fixing</td>
</tr>
<tr>
<td></td>
<td>-matter</td>
<td>Cultural control</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Allelopathy</td>
</tr>
</tbody>
</table>
APPENDIX B

SAMPLE OF NCR SARE PRODUCER GRANT PROGRAM GENERAL GUIDELINE
FOR PREPARATION OF FINAL REPORT

The following is an outline to use as a guide when preparing the final report on your project. It should be typewritten or printed and needs to be submitted to the north central region (NCR) Sustainable Agriculture Research and Education (SARE) office by .......... The Final payment of your grant will be awarded when a final report is received and a record of expenses is approved.

I. Project identification
   - Name
   - Address
   - Phone
   - Project Title
   - Project Number
   - Project Duration
   - Amount of Grant
   - Date of Report

II. Project Background
   - Briefly describe your operation (i.e. how many acres, what crops, types of cropping systems, type of livestock or dairy production, grazing systems, family operation, etc)
   - Before receiving this grant, did you carry out any sustainable practices? If so, briefly describe what they were and how long had you been practicing them.
III. **Project Description and Results**

This is the core of the report. Consider what questions your neighbors or other producers would ask about what you did with this grant.

1) List your project goal(s) as identified in your grant application.

2) Describe how you planned and conducted your research or education component to meet your project goals and discuss the results.

- **Process.** Describe the steps involved in conducting the project and the logic behind the choices you made. Please be specific so that other producers can consider what would apply to their operations and gain from your experiences.

- **People.** List other producers or businessmen who assisted with the project and explain how they were involved. List any personnel from a public agency, such as the Extension Service, Natural Resources Conservation Services or Soil and Water Conservation Districts who may have assisted with this project.

- **Results.** What results did you achieve and how were they measured? Include yields, field analysis and related data. How do these compare with conventional systems used previously? Were these results what you expected? If not why? What would you do differently next time?

- **Discussion.** What did you learn from this grant? How has this affected your farm or ranch operation? Did you overcome your identified barriers, and if so, how? What are the advantages and disadvantages of implementing a project such as yours? If asked for more information or recommendation concerning what you examined in this project, what would you tell other producers? Can you estimate the impacts (economic, environmental and social) of this sustainable practice?
IV. Outreach

What methods did you use for telling others about: 1) your project, 2) project events or activities, 3) project results? How and to whom did you communicate this information? Be sure to include details on how many people attended field days or demonstrations, and how information was further disseminated by media covering events. What plans do you have for further communicating your results? Enclose in addition to addendum any press releases, news clippings, flyers, brochures, or publications developed during this project. Also enclose any photos or slides which might be helpful in telling you story to others.

V. Program Evaluation

This was the ---year the North Central Region SARE Program sponsored a producer grant program. As a participant do you have any recommendations to the regional Administrative Council about this program? Is there anything you would like to see changes?

VI. Budget summary

Complete the enclosed budget from and return with your report. You will be reimbursed for expenses incurred, and items purchased for your project from---- to ---. Funds cannot be used to purchase refreshments for meetings. Final expenses listed by budget category, which significantly exceed the amounts in the proposal should be explained in a letter submitted with the annual report. All unspent advance funds must be returned. Please make a check payable to the University of Nebraska- Lincoln and enclose it with your final report.

North Central Region SARE Program
University of Nebraska-Lincoln
13A CAB, Lincoln, Nebraska
APPENDIX C

EXAMPLES OF ATTRA’S ALTERNATIVE SOURCES OF AGRICULTURAL INFORMATION

<table>
<thead>
<tr>
<th>Publication</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture and the environment</td>
<td>American Farmland Trust</td>
</tr>
<tr>
<td>Biodynamics</td>
<td>Biodynamic Association of America</td>
</tr>
<tr>
<td>IPM Practitioner</td>
<td>Bio-integral Resources Center</td>
</tr>
<tr>
<td>Sense Pest Control Quarterly</td>
<td>&quot;</td>
</tr>
<tr>
<td>Composting Council Quarterly</td>
<td>The Composting Council</td>
</tr>
<tr>
<td>Exchange Newsletter</td>
<td>Heifer Project International</td>
</tr>
<tr>
<td>Humane Consumer and Producer Guide</td>
<td>Humane Society of the US</td>
</tr>
<tr>
<td>Bioproducts directory</td>
<td>New Uses Council</td>
</tr>
<tr>
<td>Evergreen Newsletter</td>
<td>&quot;</td>
</tr>
<tr>
<td>The Organic Organizer</td>
<td>Organic Farmers' Market Assoc.</td>
</tr>
<tr>
<td>Technical Bulletins, Monographs</td>
<td>The Rodale Institute</td>
</tr>
<tr>
<td>Guidelines for the Organic Food Industry</td>
<td>Organic Trade Association</td>
</tr>
<tr>
<td>Newsletters, monographs, research highlights</td>
<td>Regional organic farming associations</td>
</tr>
<tr>
<td>-Land Stewardship Newsletter</td>
<td>The Land Stewardship Project</td>
</tr>
<tr>
<td>-Organic Harvester</td>
<td></td>
</tr>
<tr>
<td>-The Natural Farmer</td>
<td></td>
</tr>
</tbody>
</table>

"ATTRA has a diverse range of alternative sources of information that traverse all regions of the country. These examples merely constitute an illustrative window into the type of information resources available to the institution and are by no means exhaustive."
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