Facilitating the Transition from Conventional to Sustainable Farming Systems on Six Farms in Southern Quebec

by

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Abstract

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The transition from conventional to sustainable farming has been limited in Quebec by the absence of a comprehensive strategy, applicable at the farm level, to facilitate the transition process. This study summarizes the popular discussion pertaining to planning the farm transition, and the following six concepts that are useful to take into account when designing sustainable systems: vision, creativity, values, the efficiency - substitution - redesign spectrum, an holistic, systems perspective of the farm, and popular participation in the development process. Case studies of six farms in the early phase of transition are presented. Farm and farmer characteristics are detailed as well as the potential of each to influence the evolution of the farm. The outcomes of farm-level planning and activities in the first two transitional years are described. Particular attention is paid to the implications of creative visioning and approaches to problem solving, value adjustments, decision-making criteria, and the farmers' perceived restraining forces. A comprehensive, practical strategy designed to facilitate the farm transition process is constructed. This combines the current popular template for appropriate planning and the theoretical constructs of sustainable development, with insights gathered from the six case study farms. Finally, procedures for using the strategy are outlined, together with some requirements for its further development.

Résumé

M.Sc. Susan Green Ressources renouvelables

Faciliter la Transition de Six Fermes, dans le Sud du Quebec, de Systemes Agricoles Conventionnels à Durables

Au Québec, la transition de l'agriculture conventionnelle à l'agriculture durable est limitée, au niveau de la ferme, par l'absence d'une stratégie détaillée qui en faciliterait le processus. Cette étude résume la littérature populaire sur la transition, de même que les six concepts suivants, dont il faut tenir compte dans la conception de systèmes durables: vision, créativité, valeurs, l'échelle efficacité-substitution-reconception, une perspective globale et systématique de la ferme, et la participation populaire dans le processus de développement. Des études de cas de six fermes en début de transition sont présentées. Les caractéristiques des fermes et des fermiers sont données ainsi que le potentiel de chacunes à influencer l'évolution de la ferme. Les résultats, au niveau de la ferme, de la plannification et de l'application des deux premières années de transition sont décrits. Une attention particulière est portée à la résolution de problèmes par une approche et une vision créative, à l'ajustement des valeurs, aux critères des processus de décisions et aux obstacles perçus par les producteurs. Une stratégie pratique et complète est elaborée pour faciliter le processus de transition. Celle-ci marrie les approches de plannification du moule populaire et les concepts théoriques attachés au développement durable, à l'information receuillie sur les six fermes étudiées. Finalement, les procédures pour l'utilisation de la stratégie sont définies, de même que des prérequis à son développement futur.

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Finally, the project would not have been possible without the active involvement of the six participating farmers. Their enthusiasm and candor, and their accessibility and responsibility as both co-researchers and food producers is a source of hope and inspiration for future sustainable agriculture development efforts.

Table of Contents

Table of Contents (Cont'd)

List of Tables

List of Figures

Preface

This is a study about farming, the people involved, and the process of change.

Interest in environmentally sound farming practices is increasing within the farming community. Within Quebec there is a lack of locally-relevant information on transitional systems, and of model sustainable farms. Consequently, this study was designed to generate such locally-relevant information, and develop transition strategies, i.e., those that are applicable at the farm-level, responsive to the site-specific nature of the transitional farm, and that accomodate an holistic outlook of the farm and its supporting environments.

Although the perceived audience was transitional farmers and the extension personnel working with them, the findings are likely to be of interest to all those within the agricultural milieu concerned with the development of a more sustainable agricultural system.

Prior to beginning this study, I was living in a rural village in West Africa. In retrospect, I have found that the two years I spent in the tropics have strongly influenced the constructs developed in this study. My interest in traditional agricultural practices and indigenous knowledge systems has formed the basis of the following considerations. These comprised the initial foundations of the project, and they encompass my own assumptions and biases:

- Questions about how people farm; why they farm in particular ways; and how people (especially farming people) relate their activities to the larger environment, have led me to examine the development of environmental ethics (learning from nature and working with nature's processes and cycles), and the adjustments in values that this will entail within our society.

- My interest in indigenous knowledge led me to investigate the farmers' contextual insights, and their importance in the development of an ecologically sustainable agriculture. I studied the role of farmers in the farm development process; the importance of public participation in the development agenda; and the overriding importance of personal (anonymous) empowerment.

- Furthermore, I wanted to take part in a project that could accomodate the ideals of "action for development and change"; control of the development agenda by those directly affected by it; and that would permit my own active and immediate involvement in the promotion of sustainable farming systems.

I confronted these challenges by employing an action research approach, working collaboratively with a group of six farmers who were in transition from conventional to more sustainable farming systems.

The work is original in four ways. To my knowledge, it is the first in-depth case study of transitional farms in Quebec. Although studies from across the United States and Europe are becoming increasingly available, most fail to recognize the importance of locally-generated knowledge. Second, few North American or European studies have focussed on the key role played by the farmer in the farm development process. Third, this study was unusual in that it was an action research project concerned with farm evolution and effective on-farm change. To accomodate these ideals, it was necessary to depart from the the quantitative and reductionist research paradigms. The co-researchers involved (university personnel and farmers) used instead an experiential and participatory approach, within an holistic perspective. Qualitative methods were employed to gather and interpret information. Although these approaches are not new, they have been less frequently employed in agricultural research. Finally, a practical model was devised to facilitate the farm transition process. Based on the insights gathered on six case study farms, it is, to my knowledge, the most comprehensive transition model yet to be documented.

CHAPTER 1: INTRODUCTION TO THE STUDY

Problem Statement

Transition from "conventional" (high chemical and energy-input, specialized, environmentally stressful) farming systems to ones that minimize dependence on imported/synthetic chemicals, are more self-reliant and diversified, and are based on ecological principles poses many challenges for farmers.

Scientific research has focussed on comparing conventional farming operations with organic/low input counterparts, and the benefits and drawbacks of each. Much data on individual components of these alternative systems (e.g., mechanical-cultural weed management, green manures and cover crops, composting) are becoming available. Effort has also gone into determining the effects of employing alternative practices with regard to various biotic criteria (e.g., soil nutrient cycling and soil life, weed cycles, pest incidence) and economic criteria (production and profitability). However, research integrating these practices into whole-farm management strategies is lacking. Sriskandarajah et al. (1989) warn that "improving the component parts of the farming systems does not necessarily result in improvements to the whole system" (p.1). Recently, efforts to design and develop sustainable and low input farming systems have increased. Comparatively few studies, however, have gone beyond the component approach to look at the entirety of a "farming system"; and fewer still have looked at its interrelations with the surrounding environmental and social support systems.

Popular organizations (e.g., advisory and extension services, on-farm research groups) have concentrated on developing a framework to facilitate farm transition planning, and on testing and developing alternative practices under farm conditions.

Perhaps the most valuable resource, experienced farmers, have surprisingly been forgotten in most studies of sustainable farm development.

Some government interest has been reflected in the funding of alternative technology development and transfer projects. Again, the focus has tended to be on components rather than the whole, and the short- rather than long-term. Production groups, Participatory On-Farm Research and Development (P-OFR/D) organizations, and farmer-to-farmer extension activities are promising means of information collection, generation and dissemination. As of yet, however, very few model sustainable farming systems have been established in Canada and Quebec. Only a minority of farmers are involved in farm transition; and the focus tends to be technical and economic.

Objectives

This study was part of an on-farm, participatory research project concerned with facilitating and supporting the transition from current, conventional farming systems to more sustainable systems.

The main objectives were:

(1) i) To construct and evaluate a general framework for planning the farm transition based on a synthesis of popular discussion.

ii) To review the theories of sustainable systems design.

iii) To incorporate these into a theoretical model for facilitating the transition process.

(2) i) To follow, using a whole-farm perspective, the early transitional period of six farms in southern Quebec. This case study approach was designed to increase the limited body of information on whole-farm, transitional systems in this region. Specific concerns included:

(a) understanding the farm as a system

(b) understanding and addressing the issues that may help or hinder farm development towards sustainability

(c) planning and identification of appropriate actions for transition.

ii) To develop a comprehensive strategy for facilitating the farm transition. This involved the integration of insights gathered on the six case study farms with the theoretical concepts mentioned above.

(3) The overriding objective of this participatory, action research project was to effect on-farm change, through the collaborative efforts of the co-researchers involved (farmers and university personnel). The long-term objective was to strengthen the local capacity to deal with evolving issues and thus sustain the farm development process (Waters-Bayer & Farrington, 1990).

Thesis Organization

The research approach and methodologies employed during this study are described in the remainder of Chapter 1. In Chapter 2, a theoretical model for facilitating farm transition is developed. Case studies of six transitional farms are presented in Chapter 3. Insights gathered on-farm are combined with the theoretical foundations in Chapter 4, and a practical strategy for facilitating the farm transition process is defined. Overall conclusions are given in Chapter 5.

Nature of the Enquiry

(i) The Case Study Approach

Because of the complexity and holistic nature of the enquiry (i.e., whole-farm studies of early transitional farming systems), and the detailed, site-specific examination required, a case study approach was employed. Some of the more general characteristics of the case study approach are listed in Fig.1.

The case study approach has had a long history in educational research and has also been used extensively in other areas of research (Borg & Gall, 1989). "In general, case studies are the preferred strategy when "how" or "why" questions are being posed, when the investigator has little control over the events, and when the focus is on a contemporary phenomenon within some real-life context" (Yin, 1984, p.13). This, Yin continues, is because such questions deal with operational links that need to be traced over time.

The case study approach has gained popularity in agricultural research, seemingly in conjunction with the increasing interest in organic and other alternative agricultural systems. Lampkin (1988) suggests that the case study is an important research tool for the investigation of organic farming systems because, unlike surveys or other comparative study techniques, the case study approach can actually facilitate the development of these systems. Loess (1990) attests to their usefulness in developmental agricultural research worldwide. She states, "The case study approach should try to understand and describe the farming system, answer the questions of why and how an ecological farming system works, and prepare for more detailed developmental research to answer the key questions of ecological or managemental nature that arise throughout the case study. Furthermore, a case study should treat the farm as an organism, as a whole ..." (p.96).

Patriquin et al. (1986) employed a case study approach in his comprehensive description of a farm in transition, the Aldhouse Farm, in Nova Scotia. They suggest that because "Biological Agriculture" is an holistic, or systemic approach to agriculture, observations and experiments need to be conducted on whole, functioning systems. Kaffka and Koepf (1989) used this approach in their investigation of the nutrient regime of a sustainable farming system, the Talhof Farm, in southern Germany. They state, "The quantifiable causal analysis of such [alternative] systems is limited by their complexity. However, this analysis can be supplemented by case studies on whole farms ... case studies are complementary to exact field plot experiments" (90). Similarly, a project recently undertaken by the Ministry of Agriculture in Norway (Steinshamn, 1990) used the case study approach in a multidisciplinary study of 30 farms in various stages of conversion from conventional to ecological farming. They felt it to be the most suitable method for revealing the problems and constraints encountered when converting to, or practicing, ecological agriculture.

A working group discussion on "Case Studies and Conversion" (Kolster, 1990, pp.127-128) concluded that, when studying ecological agricultural systems, the following three types of results can be gathered when employing this approach:

" 1- identification of important problems relating to the goals of the farm management including a potential "killing of myths" about and within ecological agriculture; 2- analysis of farm efficiency in more than economical terms (energy, nutrients, environment, social etc.); and 3- documentation of farming systems and processes to be used in the extension services, education, and for further research" (p.127). Furthermore, they suggest that "case studies of farms should focus on farming as a human activity system, which include both farmer and project staff in a mutual learning process" (p.127).

Figure 1. Some Characteristics of the Case Study Approach.

(Adapted from Lincoln and Guba, 1985)

THE CASE STUDY:

- Is the primary vehicle for emic (open, receptive) enquiry.
  - tends toward reconstruction of the respondent's constructions rather than the positivist posture which tends toward a construction brought to the enquiry *a priori* (etic: closed, imposed).

- Provides a grounded assessment of context.
  - represents an unparalleled means for communicating contextual information that is grounded in the particular setting studied.

- Provides the detailed, information dense "thick description" necessary for judgements of transferability.

- Builds on participant's present knowledge.
  - holistic and lifelike description, rather than symbolic abstractions.

- Is an effective vehicle for demonstrating the interplay between enquirer and respondents.
  - enquirer-respondent interdependence affects data collection and analysis, interpretation and reporting. The nature and impact of this interaction can be judged from a case report far better than from a technical report.
  - the extent of enquirer biases is more detectable.

- Provides opportunities to review for internal consistency.

- Is the form most responsive to the axioms of the naturalistic/qualitative paradigm.

The axioms of the naturalistic (or qualitative) research paradigm are presented in Fig.2.

Figure 2. The Axioms of the Naturalistic/Qualitative Research Paradigm and their Relevance to this Study of Transitional Farming Systems.

(Partially adapted from Borg & Gall (1989), and Lincoln & Guba (1985)).

Axiom
• Research involves holistic enquiry carried out in a natural setting.

Relevance to this study
- on-farm, whole-farm, site-specific enquiry.

Axiom
• Humans are the primary data-gathering instrument.
  . relies largely on human powers of observation.
  . characteristics that uniquely qualify humans as the instrument of choice: responsiveness, adaptability, holistic emphasis, knowledge base expansion, immediate processing, opportunities for clarification and summarization, opportunity to explore atypical or idiosyncratic responses.

• Emphasis on qualitative methods.
  . qualitative data-gathering procedures are preferred because of their amenability to the diversity of "multiple realities" one finds in complex field situations.
  . e.g., interviewing, observing, reviewing available documents and records, taking account of non-verbal cues, interpreting inadvertant and unobtrusive measures. Quantitative procedures may be used in conjunction with qualitative measures.

Relevance to this study

- The primary data-gathering method was participant-observation
(See discussion of methodology in "Methods of Data Collection and the Case Sudy Data Base").

Axiom

• Selective rather than random sampling.
  . "The naturalist begins with the assumption that context is critical ... each context is dealt with on its own terms" (Lincoln & Guba, 1985, p.200).
  . "The object of the game is not to focus on the similarities that can be developed into generalizations, but to detect the many specifics that give the context its unique flavor" (Lincoln & Guba, 1985, p.201).

Cont'd . .

Relevance to this study

- locally unique, site-specific nature of transitional farming systems.

Axiom

• Inductive data analysis.
  . rather than testing preconceived hypotheses, new understandings, generalizations, and unanticipated outcomes are drawn from the data.
  . may start with a broad theoretical framework or tentative working hypothesis to provide initial general guidelines.

• Development of a grounded theory.
  . theory is developed from the data.
  . "No *a priori* could anticipate the many realities that the inquirer will inevitably encounter in the field, nor encompass the many factors that make a difference at the micro (local) level" (Lincoln & Guba, 1985, p.205).

• Design emerges as the research progresses.
  .begins with a very tentative (or no) design.
  .permits emerging design to include variables not anticipated prior to the start of observation.

Relevance to this study

- Site-specific strategies for transition unfolded as the study proceeded.
- A theoretical framework for transition was initially developed as a preliminary guide.
- A practical strategy for facilitating the transition process developed as on-farm insights emerged and were combined with the theoretical foundations.

Axiom

• Negotiated outcomes.
  . much can be learned from human subjects simply by asking for their perceptions. All participants are involved in determining the results of the study, and this is a continuous process throughout the study.

Relevance to this study

- This was a participatory research project. Farmers and university personel worked together for farm development. Discussion, interaction, and teamwork were important tenets of the study. Results were the fruit of constant collaborative effort.

Cont'd ...

Axiom

- Utilization of intuitive insights.
  . tacit or intuitive knowledge is given legitimacy because of the complexity of the situation, and since much of the interaction with subjects may occur at the subjective or intuitive level.

Relevance to this study

- Contextual insights, hunches, and intuitions of all co-researchers were invaluable throughout the study.

Axiom

- Idiographic interpretation.
  . "What is found in some particular context has meaning only in the idiographic sense for that context at that time" (Lincoln & Guba, 1985, p.216).
  . focusses on context-bound understanding, rather the context-free generalizations.

- Tentative application.
  . the transferability of the results to other situations must be assessed for each case, and is based on the similarity of "senders" and "receivers".

Relevance to this study

- "Thick" descriptions (detailed, contextual information) are provided for six transitional farms. The relevance of the results of this study to other farm systems can be judged if similar detailed information about the "receivers" is available.

(ii) Experiential/Participatory Research and Development

Kolb (1984) states, " ... our survival depends on our ability to adapt, not only in the reactive sense of fitting into the physical and social worlds, but in the proactive sense of creating and shaping those worlds" (p.1). Proaction through participation was an important tenet of this study.

The Participatory On-Farm Research and Development (P-OFR/D) ideal (Chambers & Ghildyal, 1985; Chambers & Jiggins, 1986; Chambers et al., 1989; Patriquin, 1989, 1990; Sriskandarajah et al., 1989) defines research and development as a collaborative process between farmers and scientists/extensionists. All participants become co-researchers and co-learners in the development process. Some characteristics of the P-OFR/D ideal are listed in Fig.3.

Experiential research has been defined as research in which the subjects of the research contribute not only to the control of the research, i.e., the activity that is being researched, but also to the creative thinking that generates, manages, and draws conclusions from, the research. And researchers, in such a model, contribute not only to the creative thinking and management, but they also participate, like the subjects, in the activity that is being researched (Heron, 1981). Bawden (1990) broadens the experiential concept, defining experiential learning as "knowledge for being" (p.311). This study combines the experiential and participatory ideals as the most suitable approach to effect sustainable change on-farm.

Figure 3. Some Characteristics of the Participatory On-Farm Research and Development Ideal.(Partially adapted from Chambers & Ghildyal, 1985; Chambers & Jiggins, 1986; Chambers et al., 1989; Elden, 1981; Francis, 1990a; Patriquin, 1989, 1990; Sriskandarajah et al.,1989; Waters-Bayer & Farrington, 1990).

PARTICIPATORY ON-FARM RESEARCH AND DEVELOPMENT:

- responds to unique situations and contexts
- responds to unique questions and concerns

site-specific

- encourages broadened focus to systems interactions / whole-farm studies

holistic

- is learning for action, development, and being
- fosters local initiatives
- strengthens local capacity to deal with issues, and control and sustain the development process
- helps undercut the polarity of active creators/scientists and passive consumers/farmers

participation

empowerment

- encourages farmer-farmer networking
- fosters cooperation within the farming community
- is farmers and scientists/extensionists collaborating as co-researchers and co-learners (catalysts, consultants, collaborators, collegues)
- non-hierarchical exchange of information

communication

Farmers' knowledge, inventiveness, and experimentation have long been undervalued (Chambers, 1983). This study builds on the premise that farmer innovation and knowledge of his/her own specific agroecosystem is not only valuable in agricultural development efforts, but is necessarily the main source of sustainable agricultural development. Richards (1985, 1986) suggests that many environmental problems are localized and specific, and require local, ecologically particular responses. The issue, he continues, is how to stimulate such site-specific responses. One answer is by mobilizing and building upon existing local skills and initiatives.

Sriskandarajah et al.(1989) define farm system sustainability as "persistence and an intrinsic property of the farm vested in the farmer" (p.4). This, they continue, "calls for a major shift in the worldview of farmers and of the professionals who help them ... a new social ecology for agricultural and rural development which brings with it the need for a new paradigm of inquiry ... as much concerned with new systemic ways of knowing and learning-for-action, as with new knowledge and novel techniques" (p.4). They state, "Knowledge is not a commodity for transfer from the informed to the uninformed, but the outcome of a dynamic, collaborative process between co-learners" (p.5). In this study, farmers and university personnel worked together (as co-researchers and co-learners) with the ultimate concern of farm development towards sustainability.

Warren Bennis, in his introduction to Kolb's work on experiential learning (Kolb, 1984), suggests that Kolb's treatise provides the missing link between theory and practice, between abstract generalization and the concrete instance, between the affective and cognitive domains.

This study includes a similar objective. In the early part of the study (Chap.2), a theoretical model or framework is constructed and proposed as a guide for successful farm transition. Through the experience of working on-farm with six transitional farmers, this model was expanded (Chap. 4) to reflect the full reality of managing the farm transition process.

(iii) An Holistic Systems Approach

Bawden (unpublished) suggests there have been major shifts throughout the evolution of agriculture. He pictures a spectrum comprising the eras of pioneering, production, productivity, and persistence (or sustainability), where each phase complements (rather than replaces) its predecessor. Also, "Each era is characterised by a change in the way people "see" agriculture and thus in the way they go about practicing it" (Bawden, unpublished, p.2). Similarly, a hierarchy of research enquiry and problem-solving methodologies exists (Bawden, Macadam, Packham & Valentine, 1984; Macadam & Packham, 1989; Sriskandarajah et al., 1989). The spectrum comprises approaches from reductionism to holism. These two spectrums are illustrated in Fig.4. The link is the increasing level of complexity as one shifts either agricultural era, or problem focus of the research paradigm.

Figure 4. Shifts in agricultural development paradigms, and corresponding shifts in the nature of research inquiries.

(Adapted from Bawden et al., 1984; Bawden, unpublished; Hill, 1991; Macadam & Packham, 1989; Sriskandarajah et al., 1989).

Major Shifts in Paradigms for Agricultural Development		Corresponding Shifts in Research Paradigms
Agricultural Era:	**Problem Focus:**	**Nature of Enquiry/ Methodological Approach:**
		HOLISM (Systemic, Participatory, Action Research)
PERSISTENCE (ecological design and management)	**Paradoxes** • given this complex set of issues, how can I improve the situation? (Includes higher values & goals / human development, nourishment, justice, sustainability)	SOFT SYSTEMS
PRODUCTIVITY (high input, high output production)	**Performance Maximization** • given this system, how can I maximize its performance? (productivity, profit, power)	HARD SYSTEMS
PRODUCTION (low input, low output production)	**Problem Resolution** • given this component, how can I improve its effectiveness?	REDUCTIONIST TECHNOLOGY
PIONEERING	**Puzzle Resolution** • given this phenomenon, why is it so?	REDUCTIONIST SCIENCE
		REDUCTIONISM (Scientific Experimentation)

The different methodological approaches may serve complementary roles. Sriskandarajah et al. (1989) state that, "To deal with the complex issues of contemporary agriculture and rural development, and to focus on the inter-relationships between people and their natural and socio-cultural environments, we need methods of inquiry that can accomodate the wholeness of the issues being studied. A holistic or systemic approach contrasts with the conventional approaches in agricultural science based on reductionism. Yet these reductionistic methodologies can be usefully brought to bear once the overall systemic context has been established and investigated" (p.8). Edens and Haynes (1982) suggest, "It is important to emphasize that systems analysis is both a tool and a philosophical approach to problem solving" (p.369).

Within the hierarchy of research approaches, this study "fits" into the holistic enquiry category. In this study of the evolving issues of farm transition, a whole-farm perspective and soft systems methodologies were emphasized.

(iv) Methods of Data Collection and the Case Study Data Base

Participant observation.

The main method of data generation was participant observation. For the author, this involved taking on "two roles simultaneously, that of observer and that of legitimate and committed member of the group" (Lincoln & Guba, 1985), i.e., becoming actively involved in the situation being observed.

As a committed member of the group, the author's participatory role included that of:

- Catalyst -facilitator
  .stimulating/encouraging farmer enthusiasm, critical thinking, and sharing of contextual knowledge.
  .encouraging networking among farmers and various resource people.
  .organizing relevant workshops.

- Consultant
  .gathering and sorting site-relevant information and exposing farmers to many different ideas and choices (e.g., principles and theories; technical information; systems redesign).

- Collaborator
  .active cooperation in farm development
  .sharing ideas
  .helping in on-farm trial design, monitoring/observation.

- Colleague
  .becoming a "part" of the farm system
  .becoming an "ear" for the farmer and farm family

- Co-researcher / Co-learner

Participant observation was the chosen method of data generation because:

- "... participant observation can provide the concrete detail needed for understanding. In much educational research we overlook the fact that events that appear the same may have distinctly different local meanings. Qualitative methods [such as participant observation] are probably the best means we have for discovering these local meanings" (Borg & Gall, 1989, p.407).

- It permitted gathering the detailed, site-specific (contextual) information that comprises the "thick description" of a case study.

- Direct, on-site observation was a prerequisite to understanding farming system interactions and evolution. Regular, in-depth observation improved the chances of obtaining a valid and credible picture of the phenomena (transitional systems) being studied. Also, it was only through diligent observation that the "unobtrusive cues", providing insight into the phenomena being studied, could be taken into account (Borg & Gall, 1989).

• The substantial amount of time spent on-farm allowed for rapport with the farmers to develop honestly and naturally. Trust increased as co-researchers "got to know one another".

• Quantitative measures could easily be integrated into this approach.

• It provided a valuable experiential learning experience for all co-researchers. All co-researchers were actively involved in the farm development process.

The case study data base comprised the following four components:

Field notes.

Field notes were recorded regularly in a "record of visits". These comprise the main points that arose during meetings/discussions with individual farmers; activities that took place during the farm/farmer visit; field observations; progress of informal on-farm experimentation.

Workshop notes.

A "record of group workshop activities" was kept.

This comprises workshop preparations; notes taken during workshops ,e.g., questions and issues raised by participants; workshop contents and handouts.

Background documents.

Basic farm data (farm diagrams, field histories, available soil analyses, other farm resource and background information) was kept in individual files for each participating farmer; and farmers' own records were referred to as necessary.

Other data sources.

(a) One semi-formal interview was conducted with each participating farmer. This was recorded as written notes.

(b) One written questionnaire was conducted.

(c) Information and feedback from a second student collaborator working on a partner project (Nault, 1991) was invaluable throughout the study.

(d) A resource file was kept, containing the reference documents used throughout the study.

A variety of data displays and conceptual frameworks (Miles & Hubermann, 1984) were constructed to present and analyse the information gathered on each case-farm (Chap.3).

A recent Swedish study (Naess, 1990) used two of these methods (participant observation and sampling of basic data) in their study of the farm conversion process. These methods were chosen as the most suitable for dealing with the complexity of conducting research on systems that comprise biological, technical, economical and other social factors.

(v) Overcoming Common Problems Associated with Qualitative Research

The following are some problems commonly associated with a primarily qualitative research approach (Borg & Gall, 1989), and the means used in this study to reduce them.

Observer effects.

(a) Subjective observations, observer biases, preconceived ideas, past experience, or expectations may influence observations.

• awareness that biases can exist; critical introspection; regular consultation and feedback from co-researchers and other team members; negotiated outcomes.

(b) Observer omissions/ decisions on which data to include.

• co-researchers decided beforehand categories of data that were to be observed; team member corroboration.

(c) Impact of the observer on the observed.

• trust, partnership, and collaboration were fostered over the study period as time spent on farm was substantial; effects of observer on observed, and vice versa, were fruitful for farm system development; also, the "human subject" was just one part of the larger subject observed, i.e., transitional farm systems.

(d) Reliability decay / periods when motivation and monitoring decline.

• the spirit of cooperation and teamwork provided motivation and encouragement throughout the study; records and insights from the partner project (Nault, 1991) served as important corroborative data and feedback.

Lack of training in qualitative methodology and observational techniques.

• important inputs from academic advisors.

• learning from experience. "When that learning is guided by an experienced mentor, remarkable improvements in human instrumental performance can be achieved" (Lincoln & Guba, 1985, p.195).

• Yin (1984) suggests that the following skills are required for collecting data for an exemplary case study: the ability to ask good questions (and interpret the answers); being a good listener (not trapped in ideology and perceptions); adaptiveness and flexibility (new situations are opportunities not threats); a firm grasp of the issue being studied (reduces the relevant events and information to be sought to manageable proportions); unbiased by preconceived notions (sensitivity and responsiveness to contradicting information). Honestly assess capabilities at the start, then work on their development throughout the course of the study.

Lengthy observation period.

(a) Difficult to replicate.

• "thick" descriptions are provided in the case studies (Chap. 3). If similar contextual information is made available for the receiving context, judgements of transferability can be made. Transferability "must be reassessed in each and every case in which transfer is proposed. And in order to establish transferability, similar information must be available for both sending and receiving contexts" (Lincoln & Guba, 1985, p.217).

(b) Observing for too short a period of time.

• each farm was followed for a 16 month period, covering two "planning seasons" and one "growing season". Since planning for appropriate action was the main emphasis of the study, this time-scale was considered ideal, i.e., adequate to collect the necessary contextual information, nurture a "partnership" between co-researchers, and collaborate in two consecutive planning seasons.

(c) Lengthy records that can be difficult to quantify and interpret.

• diligent record keeping (refer to "Methods of Data Collection and the Case Study Data Base")

• a firm grasp of the issues being studied (reduced data and information sought to manageable levels).

• negotiated outcomes (co-researchers and all team members) helped assure reliable interpretation.

• much of the necessary interpretation of observations and data were on-going throughout the study, i.e., this was not all left to the end of the study.

My own particular world-view has, no doubt, influenced the work I have done with the group of co-researchers, and the visual representation of the final practical model (Fig.24) that emerged. However, conscientious efforts to review and address this list of "common problems" throughout the study period, as well as the participatory nature of the project itself, has helped to reduce the danger of it being flawed by any preconceived notions, biases, or haste.

CHAPTER 2: LITERATURE REVIEW -

A STRATEGY FOR FACILITATING THE TRANSITION PROCESS

The purpose of this chapter is to review the literature relevant to the construction of a comprehensive (theoretical) strategy that will facilitate the transition from present conventional farm systems to sustainable systems.

The chapter is divided into three parts: 1, a framework for planning transition, synthesized from popular discussion, is presented and assessed; 2, current theories of designing sustainable systems are explored; 3, a comprehensive, theoretical strategy is presented for facilitating the farm transition.

Part 1: A Framework For Planning the Transition - Synthesis of Popular Discussion

Contributions towards the development of a framework for planning the farm transition have come mainly from organic advisory services (e.g., Britain's Organic Advisory Service [1]), experienced farmers and farm groups, and to some extent on-farm research groups (e.g., REAP-Canada [2]; The Practical Farmers of Iowa [3]) and university extension services. Because of the "applied" or practical nature of a transition plan, and its site-specific character (Janke, 1990; Patriquin, 1989; Patriquin & Yang, 1989), this on-farm or "grassroots" approach has been most useful in developing relevant advice and methodologies.

A synthesis of the "popular" discussion pertaining to planning the farm transition is given in Fig.5. This diagram includes the necessary components to consider (farmer's goals, objectives, and initial motivation for conversion; an assessment of the current situation), and the steps to be followed (e.g., designing a crop rotation that will meet farm-specific needs, soil rehabilitation and conservation objectives; related farm-level adjustments that must be considered; preparing a field-by-field plan). Other requirements include seeking information from a variety of sources about alternative systems, and possibly becoming a member of a support group.

Scientific studies have complemented this framework, largely by developing a variety of alternative (low input/ sustainable) cropping systems, and studying their effects in terms of specific system criteria such as soil characteristics, productivity, weed cycles, pest incidence, and financial implications (Hanson et al., 1990; Liebhardt et al., 1989; Mt Pleasant, 1990; Patriquin et al., 1986; Sims, 1989; Smolick et al., 1990; Zadoks, 1989), some with particular reference to the transition period. Much effort has been focussed on nutrient regimes and cycling, and related microbial processes (Arden-Clarke & Hodges, 1988; Doran et al., 1987; Doran & Werner, 1990; Granstedt, 1990; Kaffka & Koepf, 1989; Nilsson, 1988; Radke et al., 1988; Reganold, 1988; Werner & Dindal, 1990). This is because the basis of soil fertility in ecological systems is considered to rest on providing hospitable conditions for soil life (Gershuny & Smillie, 1986; Hill, 1989).

Figure 5: A Framework for Planning the Transition — Synthesis of Popular Discussion.*

WHOLE-FARM, SYSTEMS PERSPECTIVE

I. The Farmer
goals/objectives
priorities
motivations

II. The Farm Assessment
current enterprises
past/current management
INVENTORY
resources/opportunities
constraints, limitations, problem areas
Soil, Biotic, Climatic, Physical, Human Factors

V. Seek Information

III. The Preliminary Plan of Action

Soil improvement and conservation strategy

Economic considerations
.yield projections
.financial implications
.tolerable risk

Crop rotation design
general objectives:
.meet farm-specific needs (herd/economic)
.soil conservation/enhancement
.minimize weed/pest/disease outbreaks
ADJUSTMENTS
crop diversification (choice/sequence of crops)
manure management/fertilization & manuring plan
tillage practices
stocking rate adjustments
ration adjustments
weed, pest, disease control measures
labour requirements
infrastructure and mechanization requirements
market options

- Articulate the reasoning behind all choices
- Anticipate weaknesses and limiting factors
- Answer specific questions that arise

IV. Implement a Field-by-Field Plan
time period / acreage per year
closely observe field responses
learn from experience
the plan is a flexible guide
on-farm research

VI. Become Part of a Support Group

*This framework is a summary of the popular literature. Main sources are listed in Appendix A.

Note. Dashed boxes = limited coverage in current literature.

Strengths and Weaknesses of the Popular Framework

Strengths of the Popular Framework

The popular framework (Fig.5) is an operable and potentially effective guide for initiating a farm transition plan. It advocates a whole-farm perspective. The focus is, therefore, sustainability of the system rather than efficiency of its component parts. The farmer necessarily plays an integral role in planning and implementing the transition. By examining objectives and goals, and coupling this with his/her contextual experience, an accurate initial assessment of the starting point is developed. (Previous accurate record keeping facilitates the farm assessment).

Farmer and advisor then work jointly through the steps of the framework, designing the appropriate rotation and field-by-field implementation plan. This is complemented by networking for new information, and possibly becoming a member of a support group. Each of the six elements of the framework, therefore, are valid, necessary components to consider in developing a transition plan, i.e., none are superfluous.

Although not evident in Fig.5, much of the popular literature stresses that there is no recipe for developing transition plans. As Janke (1990) says, "There are a few principles that we have learned, however, it is up to each farmer to adapt these principles to his/her situation and fine-tune the operation..." (p.20). The farmer is amply forewarned not to expect quick and easy fixes.

Documented accounts of transition planning (real-farm examples) are very valuable, however, and do make the framework more accessible (Best, 1986; Brusko et al., 1985; Kirschenmann, 1988; Lampkin, 1990b; Measures, 1990; Patriquin, 1988,1990; Samson,1989, 1989/90).

Weaknesses of the Popular Framework

1- Lack of feedback loops.

Although simplified for visual representation, the popular framework presented in Fig.5 gives a misleading "linear" impression involving setting goals, assessing the current situation, developing an appropriate plan, and implementing this on a field-by-field basis.

Although the importance of flexibility and learning from each year's experience is recognized, often the implications are not adequately emphasized. Both farmers and whole-farm systems are dynamic and evolving entities. Each year's outcomes, including increased farmer awareness and understanding, individual field responses, and overall system developments, must feed back to each of the six elements that comprise the framework. Thus, each year's outcomes may alter the farmer's insights, objectives and priorities, call for a revised farm assessment, influence modifications and adjustments of the initial plan and its implementation, affect the types and means of information generation and gathering, and possibly change the role of the support group and its members.

This attention to feedback is, in fact, essential, because all of the elements of the system are interconnected, and participate in cyclical relationships.

2- The "external" nature of information.

Importing information into the system is necessary throughout the transition period, and beyond. Understanding the principles and practices that form the basis of successful organic farming (Lampkin et al., 1986; Lampkin, 1990b; Measures, 1990), and the ecology of natural systems (Doram, 1990) is prerequisite to successful transition. Suggested means of continual "information input" include visiting well-established organic farms and other farmers who have converted, particularly in close-proximity or with similar conditions (Cleary & Martin, 1990), reading the relevant literature, and contacting appropriate extension, research, and advisory services.

The popular framework tends to emphasize gathering information from outside of the system. It fails, however, to develop the equally important concept of "internal information generation", i.e., understanding and interpreting the issues of one's own particular farm system.

Patriquin (1989) elaborates a participatory on-farm research model. He suggests this model is a crucial means for generating the site-specific (internal) information necessary for successful farm transition and development. Several farm groups are currently using and developing similar methodologies, e.g., REAP-Canada [4], The Practical Farmers of Iowa [5], The Southwest Wisconsin Farmers Research Network [6].

In addition, farmers must aquire the abilities needed to monitor and evaluate the indicators of progress. Kirschenmann (1989) suggests that "..being part of a support group is important. Gathering and sharing information with other farmers who are trying to make similar systems work on their own farm is extremely valuable ... the information and imagination generated by such groups has been an indispensable source of inspiration to farmers involved in sustainable agriculture practices" (p.110). Beyond inspiration, however, the support group (Kirschenmann, 1989; Jacobson, 1990) is a possible vehicle for exploring, developing, and testing such on-farm means of system-monitoring and evaluation.

Continued emphasis on external information gathering, without the necessary emphasis on internal information generation and the methodologies for on-farm monitoring, may prolong the transition process; and important site-specific indicators of positive and negative change may go unheeded.

3- Inadequate development of the "farm as a system" concept.

Popular discussion does stress the importance of understanding the farm as a system, and creating transition plans that take into account this whole-farm perspective. As Kirschenmann (1989, p.107) argues, the farmer should "avoid ... the temptation to change techniques without changing systems". However, this concept has not been developed adequately. Explanations, implications, and methods for embracing the totality of the "farm system" have not been developed.

Alternative techniques are highlighted and explored in much of the popular literature (e.g., Brusko et al., 1985; Granatstein, 1988; Hanley, 1980; Lampkin et al., 1986; Lampkin, 1990b; Pousset, 1981). Usually most attention is paid to the resources traditionally viewed as supporting the agricultural operation, i.e., the soil-crop-animal interrelations, inputs, machinery and buildings. However, the social and environmental support systems (Bennett, 1986; Conway, 1990; Milbrath, 1989, 1990; Savory, 1988), and their interrelationships with the farm are usually neglected.

Historically, the main criteria for evaluating success in agricultural operations have been production and profitability. The effects of conventional farming on health, society, and the environment, and on the sustainability of the farm system itself have been largely neglected. In developing alternative systems, the conventional, narrow, short-term framework for analysis must be avoided (Allen, 1990). A broader, longer-term framework (including environmental and social considerations) must be developed and integrated into the analysis if it is to achieve its purpose - the development of sustainable farm systems.

4- Failure to emphasize the intrinsic design principles of sustainable systems.

The ultimate goal of the transition is progressive farm development toward a sustainable system. What are the design elements that make a system sustainable? Until these intrinsic elements of the ultimate goal are understood, the goal itself will remain elusive. The popular framework fails to elaborate either the design principles themselves, or their importance for successful transition planning.

Overview: Transition from within.

It was mentioned earlier that one of the strengths of the popular framework is the inclusion, from the start, of the farmer as playing an integral role in developing the transition plan. It is possible, however, to interpret the framework as suggesting that a transition plan can be developed from "without", i.e., dependant on only a limited farmer presence, for goals and priorities assessment, and for some background information gathering.

If, however, sustainability is viewed as " persistence and an intrinsic property of the farm vested in the farmer ..." (Sriskandarajah et al., 1989, p.4), then the farmer is actually the key to farm system development, and must be recognized as such (Chambers & Ghildyal, 1985; Chambers & Jiggins, 1986; Chambers et al., 1989; Richards, 1985,1986). In this view, transition and sustained development are necessarily generated from within. The implication is that all of the means and methods needed by the farmer to fulfill this role must be developed and incorporated into the framework if it is to have practical value.

The simplicity of the popular framework in its current form is both a strength, it is easy to grasp and to follow, and a weakness, in that it is deceptively simple. There are gaps in methodologies, and inadequacies in the development of important concepts. Measures (1990), representing Britain's Organic Advisory Services (OAS), a consultancy for organic and transitional farmers, claims that "... the essential elements always remain the same - careful planning, a good understanding of organic farming, and a high level of management" (p.15). These certainly are essential elements, but it is my position that there are others.

In order to develop and construct fruitful, site-responsive transition plans, and to follow them through with appropriate actions, it is necessary to look for additional sources of guidance. These should reduce or eliminate the weaknesses of the popular framework, and offer further insight into managing and directing transitional systems towards sustainability. These are examined in the following section.

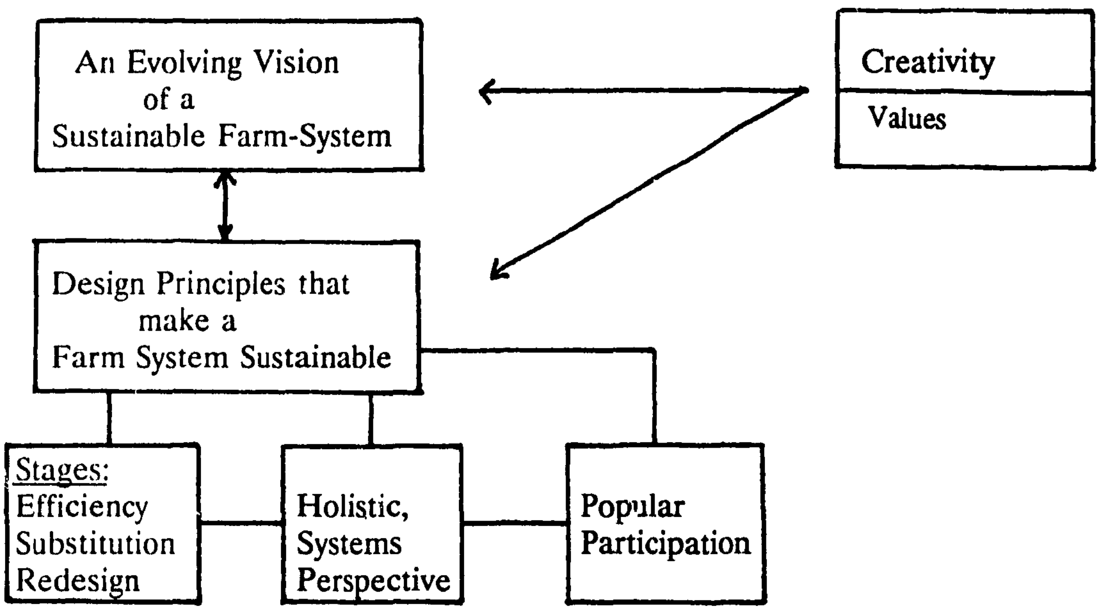
Part 2: The Theoretical Principles of Designing Sustainable Systems

The current theories relating to designing sustainable systems are drawn largely from literature on sustainable societies and sustainable development. A parallel can be drawn between designing a sustainable society, and one of its microcosms, a sustainable farm system.

Even some of the early, popular literature on transition suggested that farmers "Write out in detail a description of what [they] would like [their] farm[s] to look like at the end of transition...Then sort out the steps to reach that objective" (Hanley, 1980, p.223). A farmer in transition is not simply adopting a series of new practices and techniques. Rather, s/he is encouraging the present system to evolve towards a new, target system (Lampkin, 1990b) - the sustainable farm system. The farmer, therefore, must be able to define, at least in some preliminary way, this future system. This requires s/he understand the properties and principles that make a system sustainable.

In this section, the concept of envisioning the sustainable system and its intrinsic principles are developed. An overview of these principles is provided in Fig.6.

Figure 6. **Intrinsic Principles for Designing a Sustainable Farm System (Adapted largely from Fritz, 1989; Hill 1980b, 1985, 1990b, 1991; Savory, 1988)**



An Evolving Vision of a Sustainable System

The impetus or driving force for the design and development of sustainable systems is vision, the ability to form a picture of a desirable future that can be used to guide our actions, a coherent sense of what, ultimately, we wish to achieve (Brown et al., 1990). They suggest that societies are slowly recognizing their culpability in environmental decline. The response, however, has been fragmented attempts at targeting disjoint solutions to isolated problems, what Hill (personal communication, 13/06/91) has called "fiddling with the fine tuning of the status quo".

Robinson et al. (1990) suggest that the conventional approach to considering the future has been to project forward from present trends, making adjustments to avoid some of the uglier prospects. This approach, they warn, does not allow for the need to make more significant changes. "What is needed instead is an attempt to imagine different, more desirable futures, and to see what they would be like and how they could be attained" (Robinson et al., 1990, p.36).

Several authors have developed insightful works illustrating their visions of sustainable futures concerning sustainable systems, societies, and development paths (e.g., Brown et al., 1990; Daly & Cobb, 1989; Fairbairn, 1991; Hill 1980a,1980b,1991; Lovins, 1977; Milbrath, 1989,1990; Mollison, 1988; Robinson et al., 1990; World Commission on Environment and Development, 1987). Noteworthy, the concept of "vision" is now recognized as a valid tool in action planning, as evidenced in the recent "Summary of the Federal-Provincial Agriculture Committee on Environmental Sustainability" (1990), which is the agrifood sector committee established to address natural resource base and environmental quality issues facing the Canadian food sector.

A " major prerequisite to appropriate, sustainable change is the evolution of a hopeful and inspiring vision" (Hill, 1980a, p.24). This vision is a guiding and driving force that changes or evolves as we grow (Savory, 1988) and as the system develops and progresses.

Furthermore, vision, understanding the intrinsic design principles of sustainable systems and, consequently, the achievement of success in developing a sustainable system may be influenced ultimately by one's creativity and values (Burkhardt, 1989; Busch, 1989; Dahlberg, 1985; Fritz, 1989; Hill, 1980a,1980b,1991; Milbrath, 1989,1990; Savory, 1988).

Creativity

Hill (1985) suggests that the debilitating bonds of fear, helplessness, hopelessness, and powerlessness limit the possibility of both personal and societal evolution. These and associated states place people in a defensive-reactive posture. Driven by prevailing circumstances, we seek piecemeal repairs, attempt to avert unwanted effects, and depend on fragmented problem solving techniques rather than positive, consistent, and coherent strategies (Brown et al., 1990; Fritz, 1989). Hill (1985) continues, however, " each of us has the capacity to contradict these debilitating patterns and to play active roles in the creation and implementation of sustainable food systems" (p.35). This requires that we shift to a more creative-proactive posture.

Fritz (1989) suggests that we are, intrinsically, creative beings. Our natural instincts, desires, and tendencies are toward creating. Creativity is a positive force which, unlike problem-solving (i.e., " taking action to have something go away : the problem") is instead, " taking action to have something come into being : the creation" (Fritz, 1989, p.11). The intentions of the actions are opposite. The inventiveness of the creative process, however, " does not come from generating alternatives [a reactive posture] but from generating a path from the original concept of what [we] want to create [an evolving vision of a sustainable system] to the final creation of it [a sustainable farm system] in reality" (Fritz, 1989, pp.38-39). Similarly, Daly and Cobb (1989) advocate a positive, proactive approach in their treatise on changing paradigms for a sustainable society. They state, "People can be attracted by new ways of ordering their lives, as well as driven by recognition of what will happen if they do not change" (p.356).

Developing holistic and sustainable management plans requires creativity and thinking for oneself. "[Farmers] must create one of the few things humans can create, new ideas, custom-made to fit the situation at hand" (Savory, 1988, p.121). Each situation is unique and requires management that is an original product of human imagination. "Creativity, not brainpower, is the crucial element and it is needed constantly" (Savory, 1988, p.121).

Values

Hill (1982) states, "Only by changing our values and redefining our needs are we likely to be able to develop lifestyles that are sustainable and in balance with the support environment ... sustainable change comes about not by imposing controls from outside, but by changing ourselves from within" (p.4). Similarly, Burkhardt (1989) states,

"The morality behind sustainability will require more than just changes in technologies and restructuring of farming and resource management practices and political institutions and policies. Most basically, it will require many people changing many of their habits of mind" (p.126).

Milbrath (1989) suggests that there are currently two competing paradigms. These are The Dominant Social Paradigm (the more common, currently entrenched paradigm), and a New Environmental Paradigm, that is emerging and challenging the old position. The latter calls for environmentally-oriented thinking and social change for a sustainable society. The beliefs and values of the two paradigms are contrasted in Table 1.

Similarly, Rasanen-Lindholm (1990) talks of an omnipresent reductionist view of mankind and of nature, which harbors an ideal of technocratic efficiency. He contrasts this with an emerging "ecologi-holistic view", which emphasizes the value and integrity of nature and of the individual.

"In the end, individual values are what drive social change" (Brown et al., 1990, p.175). The ideal of the sustainable society requires value shifts favouring broadened ecological and social justice (Brown et al., 1990; Freudenberger, 1986; Gips, 1987; Hill, 1980a,1980b,1991; Milbrath, 1989,1990; Robinson et al., 1990).

Table 1. **Belief Paradigms: Contrasts Between Competing Paradigms (Adapted largely from Milbrath, 1989, 1990)**

Dominant Paradigm	New Environmental Paradigm
1. Lower valuation on nature - use nature to produce goods (exploitation) - human domination of nature/mastery over nature - economic growth over environmental protection - physical detachment/ignorance	1. High Valuation on Nature - love, respect, valorization of natural systems (conservation, enhancement) - supportive partnership/harmonious, cooperative relationship with nature - environmental protection over economic growth - contact/learning from nature/knowledge of natures workings
2 Compassion only for those near and dear - exploitation of other species for human needs - lack of concern for other people (beyond "near & dear") - concern for this generation only	2 Generalized Compassion toward - other species - other peoples - other generations
3. Risk acceptable in order to maximize wealth - science and technology a great boon to humans/swift unfettered development of science and technology - emphasis on hard technology - de-emphasis on regulation/use of the market/individual responsibility for risk	3 Careful plans and actions to avoid risk - careful assessment and cautious development of technology/social control of development and use/recognition of non-neutrality of technology - development and use of soft technology - government regulation to protect nature and humans
4. No limits to growth - no resource shortages - no problem with population - production and consumption & waste/consumerism & materialism	4. Limits to growth - resource shortages - increased needs of an exploding population - conservation
5. Present society is okay - no serious damage to nature by humans - hierarchy & efficiency/expertise - emphasis on market - competition/power - complex and fast lifestyles (wants over needs) - emphasis on jobs for economic needs - produce → consume (+ waste) - adhere to, maintain the status quo/increased standard of living	5 Need for a "new" society - in present society humans pose serious damage to nature and to themselves - openness and participation/social learning - emphasis on public goods - cooperation/love and compassion - simple lifestyles (reevaluate real needs over wants/non-material satisfaction) - emphasis on worker satisfaction - reduce, reuse, recycle - self-actualization/quality of life
6. Old Politics - determination by experts - emphasis on market control - opposition to direct action/use of "normal" channels - left-right party axis argument over ownership of means of production (socialism vs. capitalism)	6. New Politics - consultation and participation - emphasis on foresight and planning - willingness to use direct action - new party structure along a new axis (relationship between humans and nature)

Intrinsic Design Principles Supporting Farm System Sustainability

The definition of farm system sustainability adopted in this study is that of Hill (1991):

> Ecologically sustainable agriculture (ESA) is both a philosophy and a system of farming. It is based on a set of values and visions that reflect an awareness of both ecological and social realities and a level of empowerment that is sufficient to generate responsible action. Efforts to ensure short-term viability are tested against long-term environmental sustainability, and attention to the uniqueness of every operation is considered in relation to ecological and humanistic imperatives, with an awareness of local and global implications. It emphasizes benign designs and management procedures that work with natural processes and cycles to conserve all resources (including beneficial soil organisms and natural pest controls) and minimize waste and environmental damage, prevent problems and promote agroecosystem resilience, self-regulation, evolution, and sustained production for the nourishment and optimal development of all (including rural communities both here and abroad). Special attention is paid to the relationships between soil conditions, food quality and livestock health; and steps are taken to care for livestock in the most humane way possible. In practice such systems have tended to avoid the use of synthetically compounded fertilizers, pesticides, growth regulators, and livestock feed additives, and instead rely upon crop rotations, crop residues, animal manures, legumes, green manures, off-farm organic wastes, mechanical cultivation, and mineral bearing rocks to maintain soil fertility and productivity, and on natural, cultural and

biological controls to manage insects, weeds and other pests. The potential of this approach, however, goes far beyond its present expression, which has largely been limited to the substitution of environmentally benign products and practices. As this new vision of what is ecologically responsible becomes established, significant development can be expected in the science and art of agroecosystem design and management. (pp.20-21)

The Efficiency - Substitution - Redesign Spectrum.

Farm-scale transition towards sustainability is an evolutionary process that involves three overlapping stages: efficiency, substitution, and redesign (ESR) (Hill, 1985, 1990a, 1991; MacRae et al., 1990a). The characteristics of the ESR spectrum are presented in Fig.7.

Conventional agricultural operations depend heavily on shallow, curative approaches to combat problems arising within the system. These are usually in the form of external inputs (e.g., pesticides, antibiotics) that are used to alleviate the symptoms of problems. Similarly, efficiency and substitution strategies are reliant on externally-derived, curative solutions (though less resource consumptive and more environmentally benign). Overemphasis on efficiency and substitution strategies during transition hinders reaching the third necessary stage, that of redesign. In the redesign stage, problems/issues are dealt with at the causal level. Emphasis is on avoiding and preventing problems by site and time-specific management approaches.

To reach this third stage, Hill (1990b) suggests that "we require a high level of awareness, acting in the present rather than the past, appropriate information and

Figure 7. Characteristics of the Efficiency Substitution-Redesign Spectrum
(Adapted from Hill 1980b, 1985, 1990a, 1990b, 1991; MacRae et al.,1990b)

Current Chemical and Energy - intensive agricultural operations	Efficiency	Substitution	Redesign	Sustainable Agriculture Systems
	- Do the same things more efficiently (e g , banding herbicides and fertilizers; monitor pests)	- Replace environmentally disruptive inputs with benign ones (e.g., organic residues, rock fertilizers, biological controls mechanical weed control)	- Site and time specific designs and management approaches to prevent problems and achieve sustainable goals (resource self reliance; self-regulating; ecological and economic diversity) - Recovery and maintenance	

CONVENTIONAL	SUSTAINABLE
Approach to Problems	
-the problem = the enemy - shallow curative problem solving approaches ("crisis approach" eliminate enemies/cure symptoms) - external solutions (pesticides, chemical fertilizers) for internal problems - patterned, uniform responses (packages) - temporary solutions - physico-chemical strategies/imported - high power - centralized	- a problem = indicator of malfunctioning or maldesign within the system - deep, preventative strategies to avoid problem (confront the causes) - internal solutions (appropriate designs) to prevent internal problems - local responses to unique, local situations - permanent solutions - bioecological and human strategies - low-power - decentralized
Management Approach	
- reactive (solution = purchases inputs)	- creative (solution = awareness/knowledge/skills)
Time Frame	
- short-term/immediacy	long-term considerat ons
Framework	
- mechanistic/specialized; disciplinary/linear	holistic/integrative/evolving
System Features	
- monoculture - simplified in time and space - linear, "open" flows (waste) - ignore or aim to transcend limits **Maximization** - productivity, profit, political power (resource consumptive/depleting; environmentally disruptive; dependent - imports/exports) - instability - deceptive simplicity (the more successful, the more they protect and perpetuate the cause of the problem - malfunctioning, maldesigned system - inflexible - ignores freedom of choice/disempowering	- diversity in time and space - highly integrated/complexity in species and interactions - multifunctions/linkages - catalytic, synergistic, symbiotic, multi-level - balance/feedback/cycles (minimal waste/loss) - sensitive to limits **Optimization** - resilience, self-regulation, evolution, sustained production, nourishment, fulfilment, development - stability - profound simplicity/harmonious process of change - flexible - respects freedom of choice/empowering
Unforseen Outcomes	
- harmful side-effects/unexpected disbenefits - creation of new problems within the system (and beyond) - social and environmental costs	- unexpected benefits - positive/complementary effects within the system

skills, and institutional supports" (p.3). Though sustainable agricultural systems will ultimately require transformations at the global, institutional, and personal levels, "Personal transformation ... must be recognized as the only foundation upon which genuine sustainable change can be built" (Hill, 1991, p.29). Hill (1991) suggests this includes personal developments relating to creative visioning, internal and external awareness, empowerment, and shifts in values and goals.

An Holistic, Systems Perspective - "The Farm as System"

Hill (1980a,1980b) offers numerous terms describing an holistic perspective (e.g., broad, interactive, heterogenistic, comprehensive, changing). These are contrasted with terms describing a reductionist perspective (e.g., mechanistic, specialized [discipline oriented], homogenistic, limited, fragmented, unchanging). Hill (1982) suggests that an holistic approach is required to accomodate the reality of ecosystem complexity, and to take into account the often neglected complex interrelationships and time-lags between causes and effects. Similarly, in his treatise on developing a sustainable society, Milbrath (1989) states, "People must learn how to think integratively; to avoid linear thinking that considers only one consequence - often resulting in injury to the ecosystem" (p.175).

Bawden et al. (1984), Macadam and Packham (1989), and Sriskandarajah et al. (1989), propose a hierarchy of interconnected methods of enquiry, along a spectrum ranging from reductionism to holism. The corresponding problem foci range from the puzzle resolution of reductionist science, to the paradox unravelling of soft systems research (Fig.4). "The nature of reality and the way it is organized and the nature of knowledge and knowing are profoundly different between the ... methods. The purpose of research, the impact of its outcomes and the worldview of the researchers using the respective methods will also be different" (Sriskandarajah et al., 1989, p.13). The researcher-learner choses the level and methodology of enquiry depending on the nature of the problem/issue. In a review of the reductionist approach to agricultural research, MacRae et al. (1989) conclude that overemphasis on the reductionist approach has been an obstacle to sustainable agricultural development. They propose strategies for change based largely on a more holistic outlook.

The holistic perspective, transported on-farm, can be translated as "understanding the "whole" farm, or farm system". The systems concept *per se* in agriculture is not new. Early works focussed largely on the constructs and determinants, and modelling of the agricultural ecosystem. Examples are found in Dalton, 1975; Hart, 1984; Rykiel, 1984; Spedding, 1975,1984.

Attention then focussed on the complex interactions and multiple factors (socio-economic and cultural, technological, and ecological) affecting agroecosystems (Altieri, 1983,1985,1987; Altieri & Anderson, 1986; Edens & Haynes,1982; Gliessman, 1984; Hart, 1982).

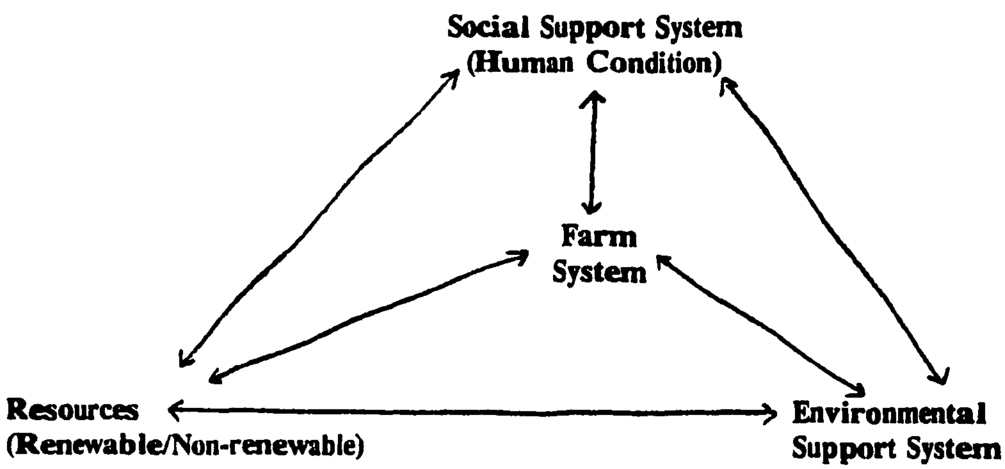
Developments within the field of Farming Systems Research and Extension (FSR/E) have included systems analysis based on interdisciplinary interaction, the use of indicators of agroecosystem performance (productivity, stability, sustainability, and equitability) and pattern analysis (Conway, 1985,1986); farmer-led systems experimentation (Caldwell & Lightfoot, 1987; Lightfoot et al., 1986); and, more recently, in participatory technology development (Chambers & Ghildyal, 1985; Chambers & Jiggins, 1986; Chambers et al., 1989; Information Centre for Low External Input and Sustainable Agriculture, 1989). Particularly these latter emphasize the key role the farmer plays in farm system development.

Systems theory is also applied to farm planning and decision making. This has been largely via the development of simulation models, e.g., for analysis and improvement of production systems, and resource allocation decisions at the individual farm level. A plethora of models representing different farming systems and their components have been developed. Bywater (1990) has compiled a partial list of models that have application at the whole-farm or whole-enterprise level. Doyle (1990) warns, however, of the limited practical use of many such models. He contends that they are potentially powerful tools, but that their conceptual rather than practical orientation has limited their impact at the farm level.

The farm system is a composite of interrelated, multifacited and multilevel parts. Mollison (1988) advocates that every component of the system should function in many ways; and every essential function should be carried out by many components. The biodynamic school emphasizes organizing the farm as a totality. "A biodynamic farm is not an organization with one or several specialized production programs. The way it is organized aims at achieving an ideal character for the farm as a whole, thus making it a self-sufficient organism" (Koepf et al., 1976, p.189). However, the farm system is not an entity in isolation. In his treatise on Holistic Resource Management, Savory (1988) suggests that "no whole ... can be managed without looking inward to the lesser wholes that combine to form it, and outward to the greater wholes of which it is a member" (p.23). And "Since greater wholes have qualities and character not present in any of their constituent wholes (parts) one must seek to understand the greater whole in order to understand its parts, and not vice versa" (p.30). In considering the "whole" farm, therefore, it is necessary to go beyond its internal constituents (or lesser wholes). The farm system is embedded in the wider environmental and social systems (Bennett, 1986; Conway, 1990).

It is useful, therefore, to consider the farm as a system that is dependent on and that affects at least three other systems (Fig.8). These include (1) all those resources, renewable and nonrenewable, used to support the functioning of the farm, (2) a social (or human) support system, and (3) an environmental (or natural) support system.

Figure 8. Inter-relationships Between the Farm and its Supporting Systems (Adapted from Hill, 1980a, personal communication, 28-03-90; Savory, 1988)



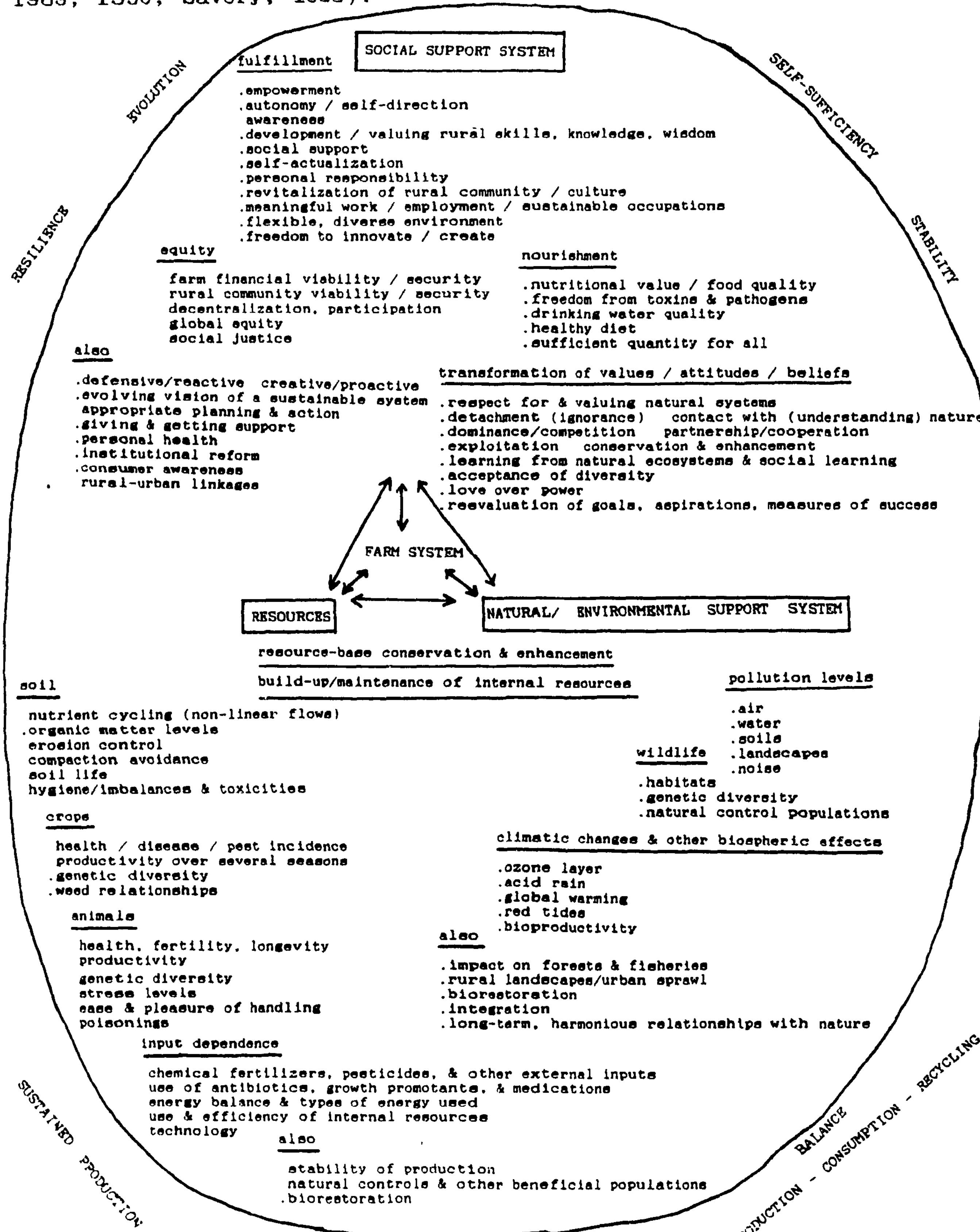
Success in agricultural operations has, historically, been based on production and profit maximization, to the expense and detriment of the environmental and social support systems. Setting production goals without reference to either the ecosystem (i.e., environmental support system) or quality of life factors (i.e., social support system) has been a common error in agricultural goal formation (Savory, 1988). To assure sustainability, equal consideration must be given to each of the three systems, otherwise one system may be favoured to the detriment of another. Likewise, to evaluate and monitor the health, evolution and sustainability of the farm system, each must again be considered, and indicators of positive and negative relationships identified. These are proposed in Fig. 9 .

Popular Participation

Popular participation is a recurring theme for those concerned with sustainable societies and sustainable development. Robinson et al. (1990), base their definition of a sustainable society on both environmental-ecological sustainability and socio-political sustainability. They state, "... the ability of all persons to participate in decision making about things that affect their lives, the lives of others and the world around them is a necessary consideration in the design and creation of all socio-political structures and institutions" (p.45).

Milbrath (1989,1990) stresses the importance of social learning in achieving sustainability in society. Further, he suggests that "A sustainable society would maximize opportunities for personal development and self-realization as the most effective way for people to realize quality in living" (Milbrath, 1990, p.125).

Figure 9. A Composite of Possible Criteria and Indicators of Farm System Health, Evolution and Sustainability. (Modified from Hill, 1980a, 1980b, 1982, 1986, 1991; Milbrath, 1989, 1990; Savory, 1988).



Similarly, Hill (1980a) proposes decentralization of power and responsibility, local self-reliance and self-determinism (as opposed to centralization; specialization; domination by and dependence on distant, elite experts, dictators, bureaucracies and institutions) for a sustainable food system.

Edwards (1989) defines development as "...people's control over the forces which shape their lives" (p.116).

Hildyard (1991) notes that local community disempowerment has occurred throughout history and that it will only be resolved when the fundamental issue behind disempowerment is confronted and ways are found for "... shift[ing] power away from the bureaucracies back to the community" (p.3). He argues that " ultimately, it is only through the direct and decisive involvement of local peoples and communities in seeking solutions to the environmental crisis that the crisis will be resolved" (p.3).

The concept of popular participation, particularly farmer participation, is evidenced in many sustainable agricultural development efforts in the "Third World". The key role that farmers must play in the farm development process is exemplified in the emphasis on farmer indigenous knowledge and innovation (Altieri, 1983; Richards, 1985,1986), the "Farmer First" model for research and extension (Chambers & Ghildyal, 1985; Chambers & Jiggins, 1986; Chambers et al., 1989), and other developments in participatory technology development (ILEIA, 1989), and farmer participatory research (Jiggins, 1989).

Similarly, participatory on-farm research is currently gaining momentum across North America. REAP-Canada, The Practical Farmers of Iowa, The Southwest Wisconsin Farmers' Research Network, the Nebraska SPARC program ["system for producer, ag-extensionist, and research cooperation"] are a few of the better known groups of interested farmers, extensionists, and scientists coming together to exchange, collaborate, and participate in a locally defined development agenda.

Waters-Bayer and Farrington (1990) suggest that such collaboration will strengthen the local capacity to conduct appropriate research and development, and as such, sustain the development process. Levins (1988) proposes that similar types of participatory research networks may "help undercut the polarity in science of active creators/passive consumers of knowledge, and contribute to democratizing science".

Patriquin (1989; 1990) suggests that a participatory approach merges research and development, accelerating the whole process; and that this approach is well suited to deal with the site-to-site variability which tends to be much greater in organic/alternative systems than conventional systems (and which is desirable).

Part 3: A Comprehensive Strategy for Facilitating the Transition Process

The strengths and weaknesses of the "popular" framework for planning the farm transition have been highlighted (Part 1). Six theoretical foundations of a sustainable society/farm system have been reviewed (i.e., vision, creativity, shifting values, ESR strategies, holistic perspective, popular participation) (Part 2).

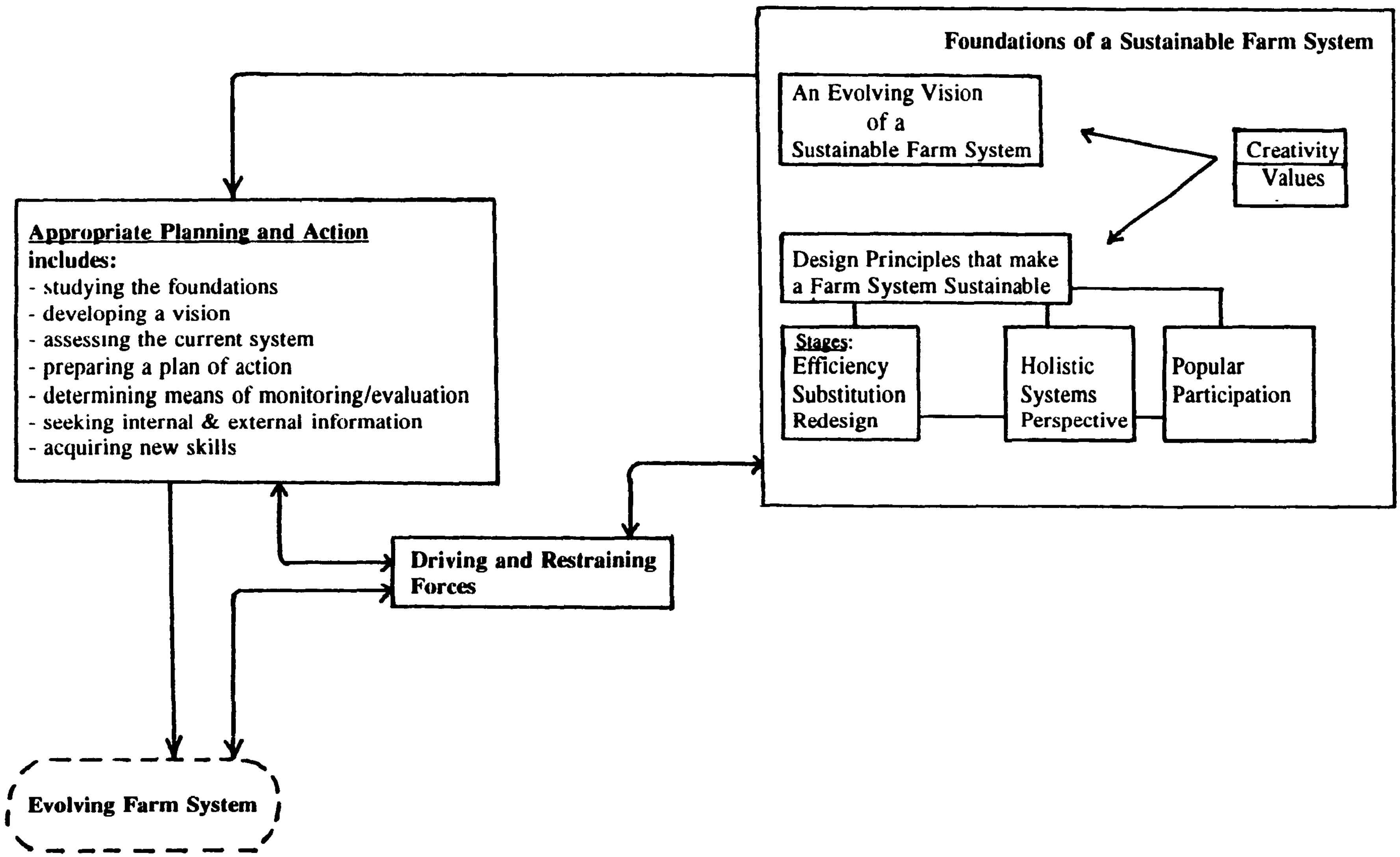
A comprehensive, theoretical strategy for facilitating the farm transition is proposed by merging the two. This strategy is presented in Fig.10.

The strategy comprises four main components (Fig.10). These include "The Foundations of a Sustainable Farm System", and the "Evolving Farm System". These two are linked by "Appropriate Planning and Action". All may be affected by a series of possible "Driving and Restraining Forces" (Hill, 1985, 1986, 1991).

The components are arranged into a recurrent cycle, or feedback loop. Understanding and awareness of the theoretical foundations of these components facilitates appropriate planning and action. Appropriate actions result in progression within the farm system, e.g., towards sustainability. Such progress, in turn, stimulates greater awareness, understanding, and eventually use of this approach to further planning and action; and so the cycle continues. Driving and restraining forces operate in all phases of the cycle.

The object of the remainder of this study was to follow and document the early transitional period for a group of six case farms (Chap.3). Insights gathered on-farm were then used to develop a practical strategy for facilitating the farm transition process (Chap.4). This final strategy takes into account both the theoretical constructs discussed above, and the realities encountered on these transitional farms.

Figure 10. **A Comprehensive Strategy for Facilitating the Transition Process**



CHAPTER 3: DOCUMENTING THE TRANSITION - SIX CASE FARMS

The objective of this chapter is to present an overview of the early transitional process followed on each of six case farms. "Farm Profiles" are presented in Part 1. These comprise general farm descriptions, the activities undertaken in year 1 of the transition, and the planned activities for year 2. "Farmer Profiles," and their influence on farm evolution, are presented in Part 2.

Part 1: Farm Profiles

All farmers from one "syndicat de gestion", located in southern Quebec, were invited to participate in this project. Six farmers attended the first meeting, where the study was presented as an on-farm research project focussing on ecologically-sound practices. Four of these, along with two who later heard of the project, formed the "self-selected" group of six case farms which were followed for a 16 month period from January, 1990 to April, 1991. Each farmer initially agreed to participate in the project because of a desire to learn more about environmentally-sound farming practices. The primary motive was to reduce dependence on synthetic inputs. At the start of the study, only one of the six farms (Table 2,farm C) was committed to transition to certified organic farming.

All six farms are situated in southwestern Quebec, west of the Richelieu River and close to the United States border. The region is predominantly flatlands at low altitudes.

At the time of this study, all six farms were owner/family run and medium-sized, but the mix of commodities varied. All were full-time farmers, who derived most of their income from farming. Some characteristics of each farm at the start of the project are listed in Table 2.

<u>Year 1 Activities: January through December, 1990</u>

In the first year, all farmers participated in a series of group and individual activities, both on- and off-farm (Table 3).

Group activities (workshops, farm field days, various forms of networking) facilitated information sharing between participating farmers, answering questions general to the group, gathering and sharing information with other resource people, and sharing results of trials both within and outside of the participating group.

Individual activities included a series of meetings between each farmer and the university co-researcher(s). The aim was to clarify goals and interests, gather and share site-specific information, discuss site-specific queries and options, plan appropriate trials and other on-farm activities, observe and monitor. The farmers also read relevant literature, contacted other farmers, and conducted on-farm trials. Most of these informal experiments comprised trial fields or unreplicated strips with a control (Fig.11).

Table 2. **Farm Descriptions**

Background Information	FARM A	FARM B	FARM C	FARM D	FARM E	FARM F
Main Production	Cash crops	Cash crops	Beef finishing feedlot	Dairy	Dairy	Dairy
Cultivated Land Base	Prior to 1990 - 122 ha 1991 - 155 ha (39 ha is owned by brother & is needed for hay	150 ha (10 ha owned) (140 ha rented)	65 3 ha arable + 28 ha largely pasture	Prior to 1990 - 86 ha 1991 - 65 ha	1990 - 83 ha 1991 - 35 ha	122 ha
Herd Inventory	-	-	Finishing 200 steers/year	65 animal units	55 animal units	150 animal units
Livestock Housing	-	-	East side open barn with slatted floors	Tie stall barn Milk pipeline	Tie stall barn Milk pipeline	Free stall/slatted floors Milk parlour
Manure Management System	Access to solid dairy manure (no adjustments for liquid catch) 50-70 ton/ha every 5-6 years. Fall spread; usually onto hay, plowed	-	Liquid Underground resevoir. Spreading is contracted. 50000-70000 l/ha every 4-5 years. Fall spread; plowed.	Piston system. Solid manure (no adjustments for liquid catch). Spreading in cooperation with 2 other farmers with rented machinery 50-60 tons/ha every 3-4 years. Fall spread, plowed	Chain & elevator. Solid manure. Earthen catch for liquids. Spreading is contracted Quantities undertermined Fall spread; plowed.	Liquid. Outdoor reservoir. Spread onto sorghum in Spring, onto corn in Fall. 50000-80000 l/ha.
Crops grown as a percentage of arable land base prior to 1990	Corn = 45 0% Wheat = 5% W. Wheat = 8% Barley = 10% Hay = 32%	Corn = 85% SB = 13% Hay = 2%	Corn = 75% Spring Cereal = 11% Alf = 14%	Corn = 20% Barley = 25% Hay = 55%	Corn = 60% Hay = 40%	Corn - (HMEC) = 34% Sorghum = 9% Hay = 57%
Weed Management	Chem & Mech (cultivation in corn)	Chem & Mech (cultivation in corn)	Chem & mech (cultivation in corn)	Chem	Chem	Chem & mech (cultivation in corn)

Note. HMEC = high moisture ear corn; Chem = chemical; Mech = mechanical

Table 3. Schedule of Activities - Year One

* (Number in brackets denotes how many of the six participated in each activity)

JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE
Workshop 1 Establishing group priorities and objectives (4)	Workshop 2 Soil processes in biological agriculture (3)		Workshop 4 On-Farm Trials (5)		
	Workshop 3 Alternative Practices - Emphasis Crop Rotation (6)				
				Field Demonstration: Finger-Weeder (6)	
					Networking: Hosted Visitors from Macdonald College (5)
INDIVIDUAL MEETINGS (6)					
				ON-FARM TRIALS (6)	
FARMER'S PERSONAL RELATED ACTIVITIES (6) - networking with other farmers - reading appropriate literature - attending conferences/seminars/courses - conducting on-farm tests - system observations and record keeping					

Continued

Table 3. Schedule of Activities - Year One (Cont'd)
* (Number in brackets denotes how many of the six participated in each activity)

JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
					Workshop 5 End of season evaluation (5)
	Field Demonstration· On-farm soil evaluations (6)	Farm Field Day Green manures (farmer-hosted) (5)			
Networking. Farm tours of Ontario organic farms (2)	Networking. Hosted visitors from REAP - Canada (4)	Networking. Hosted visitors from REAP - Canada (2)			
Networking. Farm tours of rotational grazing in Vermont (1)					
			Videotaping. Green manure taped on one participating farm (2)		
			Video watching - Rotational grazing - REAP On-Farm Research (3)		
INDIVIDUAL MEETINGS (6)					
ON-FARM TRIALS (6)					
FARMER'S PERSONAL RELATED ACTIVITIES: (6) - networking with other farmers - reading appropriate literature - attending conferences/seminars/courses - small on-farm tests/systems observations					

Figure 11. On-farm Activities (Informal Experiments) - Year 1.

Trial Categories	A	B	C	D	E	F
I. Green Manure						
(a) Sown after harvest of main crop.						
(i) Oil radish	X		X	X	X	X
(ii) White mustard	X			X		X
(b) Interseeded into cereal main crop.						
(i) Red clover	X					
(ii) Alsike Clover	X					
(c) Ploughdown of buckwheat				X		
II. Corn Interseeds & Mechnanical Weed Control						
(a) Within corn rows at seeding						
(i) Polebeans			X	X		
(ii) Soybean			X			
(b) Between corn rows after cultivation (grass/legumes/grass-legume mixes)		X	X			
III. Fertilization Regimes						
(Reducing fertilization in grain corn after hay/legume ploughdown)	X	X				
IV. Winter Cereal Survival						
(a) Seeding mixed winter cereals			X			
(b) Sown with spring oats as a snow catch			X			
V. Mechnaical Weed Control in Soybeans						
Rotary hoe		X				

Column headers A–F are under the spanning heading **FARMS**.

VI. **Whole Farm Adjustments**

Farm A -Purchased Lely® weeder.

Farm B -On a small section of the farm (10 ha) implemented a new rotation (Fig.12).

Farm C -Developed and began implementing a new rotation over the entire farm (Fig 12).

Farmers set up and conducted the trials using their own machinery. In some cases the objectives were general (e.g., gaining experience with a particular practice or technique), and in others more specific (e.g., generating site-specific information or fulfilling a site-specific purpose, for example, spreading liquid manure onto an oil radish "sponge" in late summer rather than onto corn stubble in the fall).

Year 2: Planning and Activities, 1991

Group and individual activities scheduled for year 2 are presented in Table 4.

Each farmer elaborated plans for the second year of transition (and beyond) These are presented in Fig.12. Note that each farm plan is unique and that a general prototype or recipe is not followed (Janke, 1990; Lampkin, 1990b; Patriquin, 1989). However, the six farms can be divided into two categories according to the degree of restructuring taking place during the second transitional year. Significant adjustments within the 1991 farm system are planned for farms A,C,E. Emphasis on experimentation, with lesser adjustments at the whole-farm level, are characteristic of farms B,D,F.

A brief outline of the planning procedure followed on the six farms is presented in Table 5, and Figs.13, 14, and 15.

Table 4. Planned Schedule of Activities - Year Two
(Number in brackets denotes how many of the six participated in each activity).

JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT.	OCT. - DEC.
	Workshop 6 Soil fertility and on-farm nutrient cycling (6)		Workshop 7 On-farm trials - preparations for 1991 (5)		Workshop 8 *				Workshop 9 * Workshop 10 End of season evaluation
							Farm Field Day On-Farm **		
		Networking CDAQ conference bio and agr. in Que (4) REAP conference weed management (2)	**ON-FARM ACTIVITIES** - Whole Farm Actions - Trials (6)						
INDIVIDUAL MEETINGS (6)									
FARMERS' PERSONAL RELATED ACTIVITIES (6) - networking with other farmers/resource people - reading appropriate literature - attending conferences/seminars/courses									

Note.
* = topic depended on evolution of group interests/priorities
** = most promising trials of the season

Figure 12. On-Farm Plans - Year Two*

FARM A

(A) Whole-Farm Actions

Adoption of new rotation(s):
(i) Ecological Rotation

Y1	Y2	Y3	Y4 TO Y9
H	H	H	(C-SB-Winter cereal) Planted in strips

(ii) Organic Rotation

Y1	Y2	Y3	Y4 - Y8/9
H	H	H	(a series of spring and winter cereals, beans, and possibly other crops (e.g , buckwheat/flax) depending on soil/field characteristics and markets

Related adjustments within the system:

- Weed Management
  - Mechanical/cultural weed control, (Lely® weeder in cereals / cultivation in corn) + Herbicide reductions (spot spraying as required in initial years)
- Fertilization Program
  - Synthetic fertilizer reductions based on nutrient budgeting for each field
- Marketing Adjustments
  - Exploring new markets (producing seeds for reproduction and grain for human consumption)
  - Gearing towards organic markets: animal/human/seed

Continued

Note. OR = Oil radish; WM = White mustard; RC = Red clover; AC = Alsike clover; H = Hay; SB = Soybean; Y = Year; C = Corn

Nutrient budgeting = taking into account manure contributions (past 3 years), legume/hay plowdowns, and soil contributions (In the early transitional years, some top-dressing may be required Field responses and farmers experience will be key factors in fertilization programming in later years)

*Farms are listed using the following categorization: Systemic, Whole-farm planning - Farms A,C,E. Emphasis on on-farm experimentation - Farms B,D,F.

(B) On-Farm Experimentation - 1991

(i) Green Manures

(a) Varying fertilization rates following green manures of 1990 (OR, WM, RC,AC)
(b) Green manures interseeded into winter cereals (AC+RC; hairy vetch)
(c) Green manures, seeded after cereal harvest (OR,WM, OR + WM)

(ii) Comparing Corn of Varying Heat Units

- postpone seeding dates/ "false seedbed" for weed control
- take advantage of warmer soils - (intrinsic fertility and productivity)
  - reduce fertilization rates

(iii) Manure/Compost

(a) Making compost windows - dump wagon vs. manure spreader
(b) Comparing raw manure and compost

(iv) Weed Management in Soybeans

(a) Herbicide vs. Lely weeder

(v) Conservation Tillage

(a) Try "Mulch-Finisher"

FARM C

(A) Whole-Farm Actions

I. Adoption of a new rotation (continued from year one)

Y1	Y2	Y3	Y4	Y5
H	H	Winter cereal & green manure	Corn silage	Spring cereal undersown

Related adjustments within the system:

- Manure Management
  - Liquid manure aeration
  - Spreading on covered ground / attention to amounts and timings

Continued

- Fertilization Program
  - Synthetic fertilization reduction based on nutrient budgeting for each field
- Weed Management
  - Cultural - crop rotation / soil cover (e.g. corn interseeds; green manures)/ later seeding dates
    + Mechanical - primary tillage/cultivation in corn
  - Chemical - spot spraying as necessary in initial years

II. **Adoption of a rotation grazing system** (using a Tumble-wheel arrangement)

- In the first year, trying with approximately 100 steers
- Management/market adjustments
- Ration adjustments

III. **Wind powered water pump development** (to meet the needs of the animals inside the barn)

(B) On-Farm Experimentation 1991

(i) Green Manures

(a) Varying fertilization rates following green manures (OR) of 1990
(b) Green manures seeded after winter cereal harvest - compare OR, WM, rye and canola mix for possible extended grazing

ii) Corn Silage Interseeds & Mechanical Cultivation

(a) Corn with polebeans sown within the row
(b) Corn with an annual clover or ryegrass sown between the rows

(iii) Winter Cereal Survival (pending results of Year One)

(a) Species/varietal mixtures
(b) Sown with oats (earlier than Year One) as a snow catch

Continued

FARM E

(A) Whole Farm Actions

I New Orientation of the Farm System

- Farmer is changing the orientation of the farm from dairy production and selling corn, to animal breeding/sales combined with dairy production. (Decision was based primarily on the farmer's work preferences).
- Equipment for corn production has been sold.
- All animal concentrate feed will be purchased.
- Farmer will concentrate on production of high quality forages.
- The possibility of producing certified forage and a small amount of cereals came about only after having made the primary decision to change the farm's orientation.

II Adoption of a New Rotation:

Y1	Y2	Y3	Y4
H	H	H	Cereal (and green manures)

Related adjustments within system

- Fertilization Program
  - synthetic fertilization reductions based on nutrient budgeting for each field
- Manure Management (storage and handling)
  - studying options
- Extra straw use in the barn (cleaning two times/day)

Continued

(B) On-Farm Experimentation/Trials 1991

(i) Manure/Compost

(a) Making compost windrows
(b) Varying amounts and timings of manuring to determine optimum management

(ii) Green Manures

- Trying various green manures to determine best "sponge" for collected liquid runoff from manure.

(iii) Weed Management

- Trial strips without herbicides

FARM B

(A) Whole-Farm Adjustments

I Adoption of a new rotation on a small section (10 ha) of the farm

Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8
C	SB	Cereal (winter/spring) + green manure	C	SB	Cereal undersown (winter/ spring)	H	H

II Related adjustments within the system:

- Fertilization Program
  - Synthetic fertilization reductions based on nutrient budgeting for each field
- Crops
  - Small increases in the amount of soybean and hay on the farm
- Weed Management
  - Herbicide banding combined with mechanical cultivation of all corn fields

Continued

(B) On-Farm Experimentation 1991

(i) Weed Management

(a) Corn - herbicide banding and varying cultivation regimes (various combinations of rotary hoe and cultivation)

(b) Soybean - herbicide banding within 30" rows + rotary hoe + cultivation vs. 6" rows, sprayed

(ii) Corn Interseeds - seeded at second cultivation via seedbox attached to cultivator

(a) annual clover/alsike clover

(b) ryegrass in fields that will be followed by SB

(iii) Compost - composting municipal leaf collections (small scale initially)

FARM D

On-Farm Experimentation 1991

(i) Fertilization Program

- synthetic fertilization reductions based on nutrient budgeting for each field

(ii) Green Manures

(a) Varying fertilization rates following green manures (WM, OR) of 1990

(b) Green manures seeded after spring cereal harvest (WM, OR)

(iii) Corn silage interseeds and mechanical cultivation

(a) Corn with polebeans sown within the row

(iv) Weed Management in Corn

- Cultural control (later seeding date) and mechanical control (primary tillage and cultivations)

Continued

FARM F

(A) Whole-Farm Adjustments

I Modification of Current Rotation:
Addition of a cereal and green manure. The main purpose is to have covered ground on which to spread liquid manure.

Y1	Y2	Y3	Y4	Y5	Y6
H	H	H	Corn	Cereal + green manure	Corn
			H→ Sorghum		

II Adjustments Within the System:

- Manure Management
  - Liquid manure aeration
  - As much as possible, spreading onto covered ground (attention to amounts and timings)

- Heiffer/dry cow rotational grazing system

(B) On-Farm Experimentation/Trials 1991

(i) Green Manures

(a) Varying fertilization rates following green manures (WM, OR) of 1990
(b) Green manures seeded after spring cereal harvest (OR, WM)

(ii) Corn Interseeds & Mechanical Cultivation

(a) Annual clovers seeded after 2nd cultivation (no herbicide or herbicide banding)

(iii) Fertilization Regimes
(a) Testing strips with reduced synthetic fertilization based on nutrient budgeting for each field

Table 5. Overview of the Planning Procedure Followed on the Six Case Farms

<table>
<tr><th>Systemic Whole-Farm Planning
(Supported by on-farm experimentation)
Farms A, C & E</th><th>Emphasis on On-Farm Experimentation
(With lesser adjustments at the whole-farm level)
Farms B, D & F</th></tr>
<tr><td colspan="2">I. Vision - envision a future desirable system
II. Evaluation of Current Situation - (e.g. resource inventory; field histories; areas of weakness, primary motivations and objectives)</td></tr>
<tr><td>III. Design a Rotation

• Meet general objectives:
- meet farm-specific needs (e.g., herd requirements/economics)
- soil conservation/enhancement
- minimize weed, pest and disease outbreaks
- avoid labour bottle-necks
• Choose crops and crop sequence based on sound principles of rotation design (e.g., Lampkin et al, 1986; Lampkin, 1990b; Canadian Organic Growers, 1990) A checklist (Fig. 15) is a useful guide Assess each crop in light of how many functions it can perform.
• Keep in mind opportunities; anticipate weaknesses and how to overcome them; evaluate risks/potential benefits for farm and support environments.

IV. Implementation: Field-by-Field Planning

• regroup/renumber fields as necessary.
• elaborate more than one rotation for the farm if necessary (e.g., "block" the farm according to soil types, or other varying conditions)
• Draw up a field plan (Fig. 13). Consider field history, condition, herbicide residues. Poor fields may require corrective measures. This gives a flexible time-plan for transition.
• Remain flexible. Next year's plans depend on observations, experience, field response, new information and opportunities.</td><td>III. On-Farm Experimentation

• Expand informal experimentation of site-relevant alternative practices, e.g., to gain experience; generate site-specific information, fulfill a site-specific purpose.

IV. Adjustments Within the Current System
• Rotation Adjustments:
- modify current rotation to integrate alternative practices, and increase crop diversity
- initiate a new rotation on a small section of the farm
• Modify Current Practices:
- crop fertilization and manuring plan
- tillage and weed management

Continued</td></tr>
</table>

Note. The farms have been divided into two categories according to the degree of farm system restructuring taking place during the second transitional year.

V. Associated Adjustments

- Crop fertilization and manuring plan:
  - prepare a nutrient budget (field-by-field)
  - allocate manure to appropriate points in the rotation
  - amounts/timing/onto covered ground
  - efficiency of storage and handling (compost, aerate)
  - reduce synthetic fertilizers based on nutrient budgeting and field response
  - organic fertilization is an option in early years until soil organisms and cycles are functioning optimally
- Tillage and Weed Management:
  - emphasize cultural/mechanical weed management
  - attention to timing of operations and fertility-weed interrelations
- Ration Adjustments:
  - ration reformulation in light of new crops
- Market Adjustments:
  - scouting new markets in light of new crops
- Labour, Machinery, Equipment Requirements:
  - avoid labour bottlenecks
  - use available/borrowed machinery in early "trial" years
  - check available storage facilities
- Financial Implications

VI. The Livestock Enterprise

(None of the participating farmers initiated changes at this early stage, except Farm C - rotational grazing with reduced confinement feeding for part of the herd).

VII. On-Farm Experimentation

- Expand informal experimentation of site-relevant alternative practices, e.g., to gain experience, generate site-specific information, fulfil a site-specific purpose.

Figure 13. Implementing the Rotation - A Field X Time Matrix for Farm C

Field Numbers		Transition Year 0	1	2	3	4	5	6
1		Corn	Barley (green manure)	Corn (interseeds)	Barley (undersown)	Alfalfa	Alfalfa	Winter cereal (green manure)
2		Corn	Corn (interseeds)	Barley (undersown)	Alfalfa	Alfalfa	Winter cereals (green manures)	Corn
3	A	Corn	Barley (undersown)	Alfalfa	Alfalfa	Corn	Barley (undersown)	Alfalfa
	B	Oats (undersown)	Alfalfa					
4	A	Oats (undersown)	Alfalfa	Winter Cereals (green manure)	Corn (interseeds)	Barley (undersown)	Alfalfa	Alfalfa
	B	Hay	Corn	Barley (green manure)				
5		Corn	Barley (undersown)	Alfalfa	Alfalfa	Winter Cereals (green manure)	Corn	Barley (undersown)

Features of the New Rotation:

1. Increased crop diversity; sequenced to enhance the soil resource and minimize weeds
2. Increased soil cover
3. Reduced use of row crops
4. Increased reliance on high quality forage (integration with rotational grazing)
5. Winter cereal followed by green manure seeded after cereal harvest (soil cover: reduced erosion, reduced nutrient loss, weed competition, sponge for liquid manure)
6. Short perennial forage period (nitrogen fixation; high quality feed; avoid perennial weed buildup)

Note. Dashed underlining indicates transition has begun
Underlining indicates transition according to organic standards of certification has begun
Double underlining indicates transition is completed (according to standards of certification (OCIB, 1990- 1991)

Figure 14. Plan of the Redesigned Crop Rotation for Farm C.
(Adapted from Canadian Organic Growers, 1990).

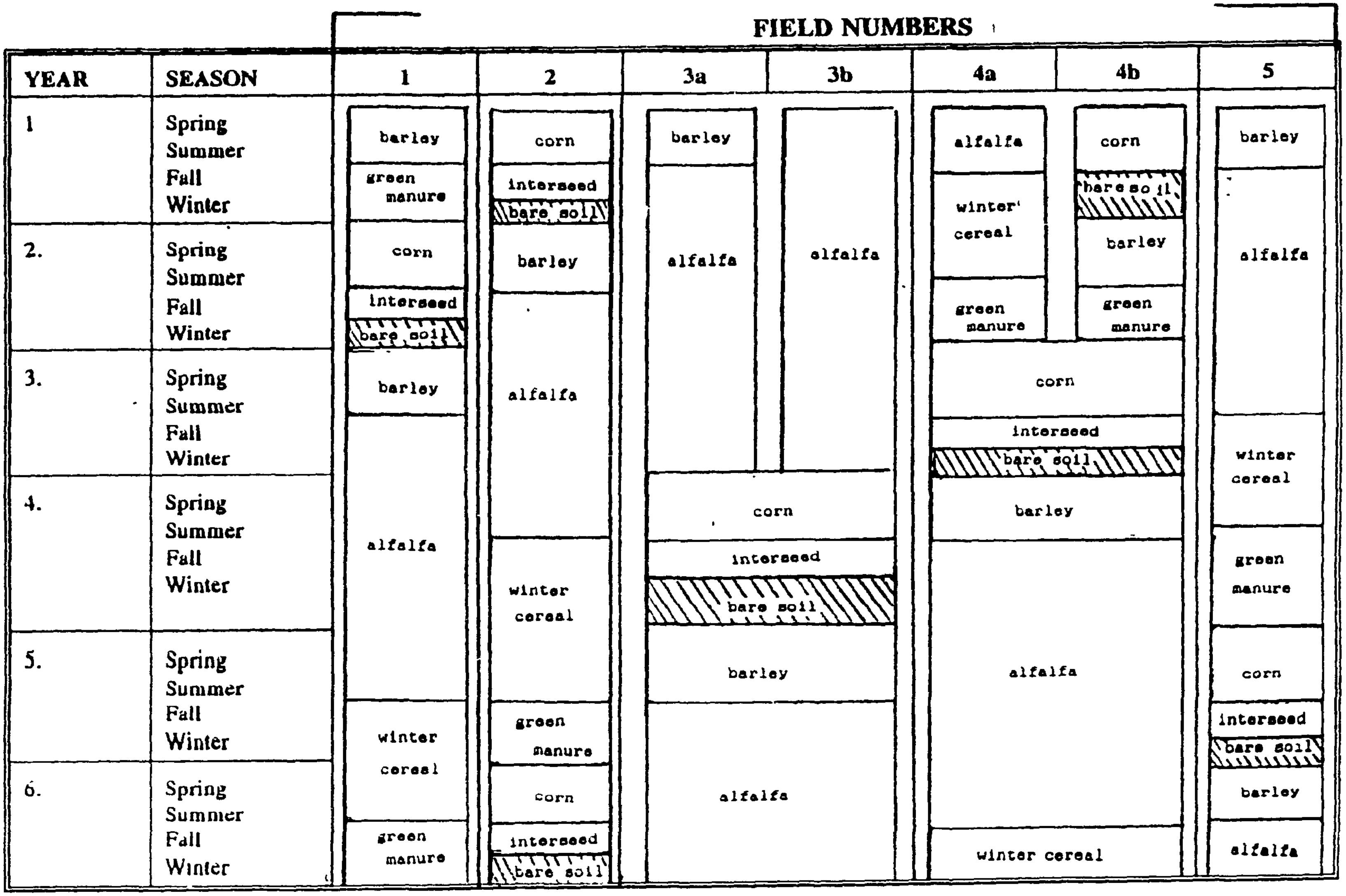


Figure 15. **Rotation Checklist.**

(Adapted from Canadian Organic Growers, 1990; Lampkin et al., 1986; MacRae et al., 1990b)

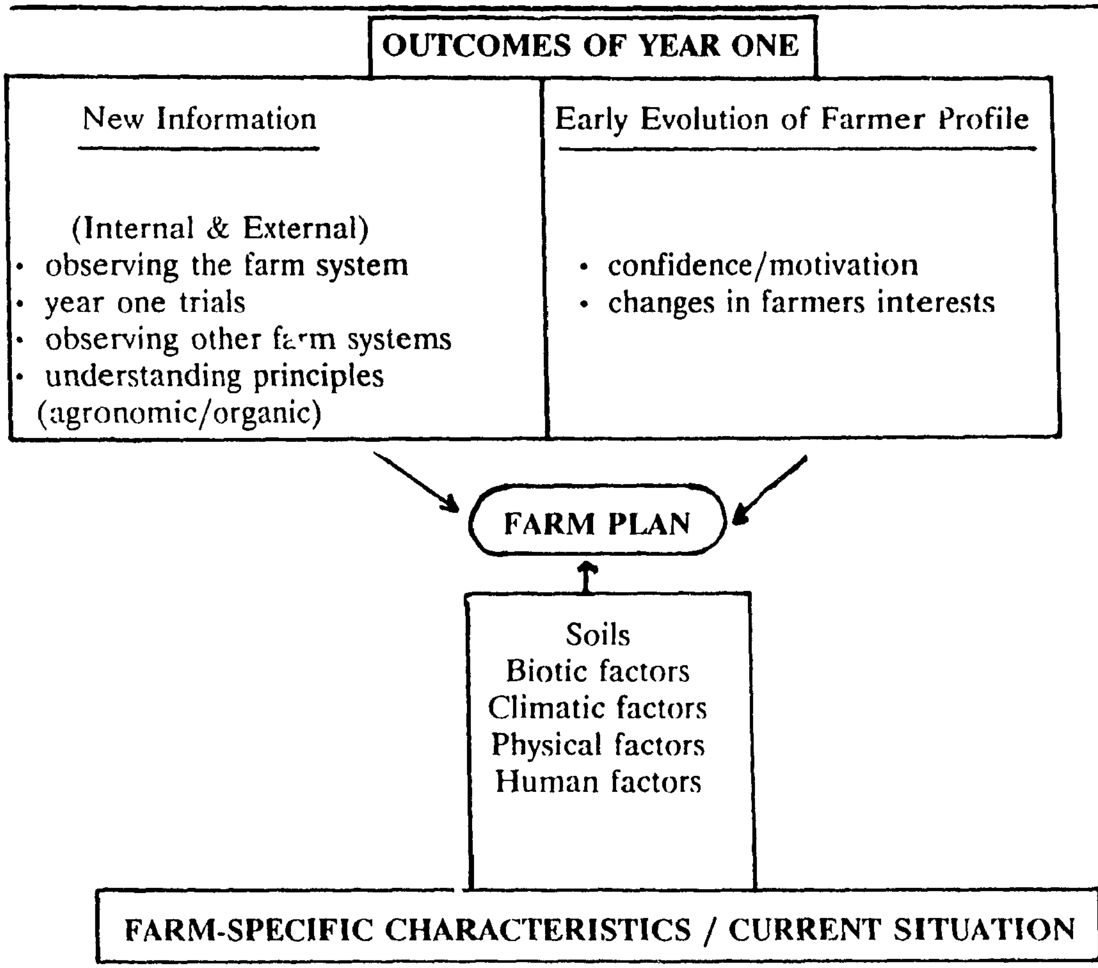
- Do deep-rooted crops (e.g., alfalfa) follow shallow rooted crops (e.g., spring cereal)?
- Do crops with high root biomass (e.g., winter rye) alternate with those with low root biomass (e.g., soybeans)?
- Do nitrogen-fixers (e.g., alfalfa; clover) alternate with high nitrogen feeders (e.g., winter wheat)?
- Do slow growing crops (e.g., corn) follow weed suppressing crops (e.g., buckwheat; white mustard)?
- Have adequate green manure and/or cover crops (e.g., oil radish; white mustard) been incorporated into the rotation to sustain fertility and maximize soil cover/minimize erosion?
- Do warm season (e.g., soybeans; corn) and cool season crops (e.g., winter cereals; brassicas) alternate, to disrupt weed cycles?
- Are there breaks between crops that may suffer the same diseases or pests?
- Do the crops allow for effective use of the existing farm machinery and labour?
- Does the rotation meet livestock feed requirements, i.e., protein and energy self-sufficiency?

Discussion

Factors influencing plan development

The plan for each farm during the second year was influenced mainly by the farmer's interests, the farm's characteristics, and the outcome of the first year's experiences (Fig. 16).

Figure 16: The Primary Factors Influencing Farm Planning for the Six Case Farms in the Second Transitional Year.



Assuming that both positive and negative, and unexpected outcomes can influence planning, farmers were asked in individual interviews to comment on the remarkable or influential outcomes of the first year that affected their planning for year 2 (Table 6). New information, both internal (e.g., information about the current farming system coming from observation and trials) and external information (e.g.,increased understanding of agronomic/organic farming principles and alternative practices as witnessed on other farms) figure prominently. Also remarkable is the change that took place at the personal level after only one year, i.e., farmers commented on their increased confidence and motivation. Negative (or disappointing) trial results from year 1, albeit small-scale, did not lower enthusiam for involvement in subsequent trials.

Scale of activities - The shift to whole-farm planning

On-farm activities of year 1 were confined largely to small-scale trials of known techniques. Planned activities for year 2, however, incorporate significant restructuring (farms A,C,E) or preliminary adjustments at the whole-farm level (farms B,D,F). These are combined with trials of expanding scope (Fig. 17).

Figure 17: The Changing Scale of On-farm Activities in the First Two Transitional Years.

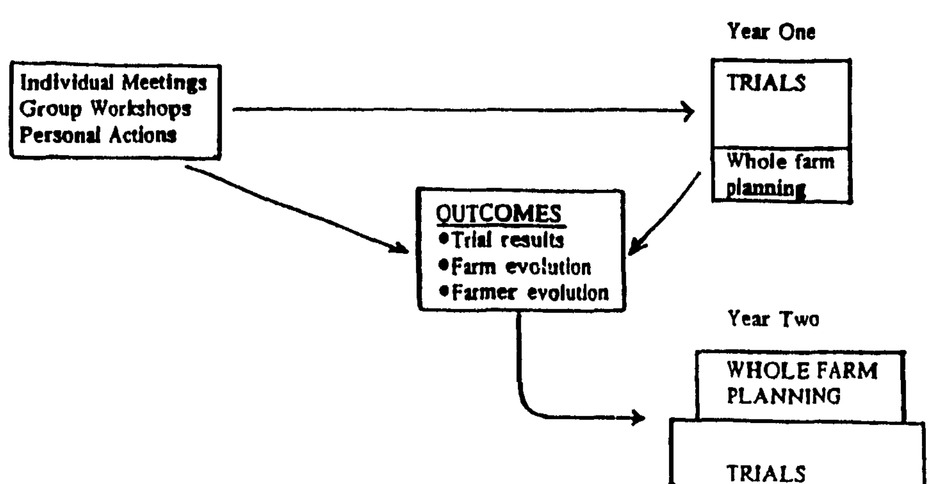


Table 6. Outcomes of year one impacting on planning for year two - Farmer Responses (Paraphrased)

FARM	Positive Outcomes of the First Year Affecting Planning for Year Two	Negative Outcomes for the First Year Affecting Planning for Year Two
A	New Info (Ext/Int) - learning some of the principles of organic farming - learning that there is life in the soil with which we have to live in harmony New Info (Ext) - increased understanding of practices (confirmed by seeing other farms/farmers) New Info (Int) - results of trials Personal Profile - increased inspiration and confidence	---
B	New Info (Ext/Int) - the realization that I put much more fertilizer than the majority of farmers in the area New Info (Ext) - increased understanding of the soil from reading and from our discussions New Info (Int) - results of trials (particularly fertilization regimes)	New Info (Int) - poor trial results for corn interseeds (but I will try them again because I'm sure it was the timing that was off)
C	New Info (Ext) - readings and trips to organic farms have been very important New Info (Int) - trial results (particularly weed control in corn without herbicides) Personal Profile - increased confidence and determination We are less fearful It doesn't matter what others say, this is what we want to do	New Info (Int) - poor trial results with soybean interseeded into corn It doesn't fit well in the system (it's slow to seed, seems to compete, but more particularly, it is difficult to harvest) However, polebeans seem to have real potential so I'd rather continue with the polebeans and forget the soybeans
D	New Info (Ext) - learning some theoretical principles New Info (Int) - trial results (particularly weed control in corn without herbicides and high protein silage with polebean interseeds) Personal Profile - by performing a few trials, I proved to myself eco-practices are possible Trying things myself has increased my motivation - my mentality towards eco-agr is changing	New Info (Ext/Int) - the realization of the quality and richness of manure as a resource is both a stimulus and a frustration how can I work better with it? I have to keep on researching this one
E	New Info (Ext) - I can see that ecological and organic agriculture are in the realm of the possible Personal Profile - realized I am not as "bad" as some people	New Info (Int) - I am not impressed with hairy vetch and ryegrass as a forage
F	New Info (Ext/Int) - Over the last couple of years we have become more aware that we can "do better", for example in terms of soil conservation New information (from numerous sources) has opened our eyes Also we have done well in conservation contests	New Info (Int) - poor trial results with green manure was due to late seedings and lodged oats We want to try this again because we have seen the better results on other farms, and is a good place to put our liquid manure (but we'll seed after barley instead of oats)

Note Int = internal (information generated on-farm)
Ext = external (information coming from off-farm)

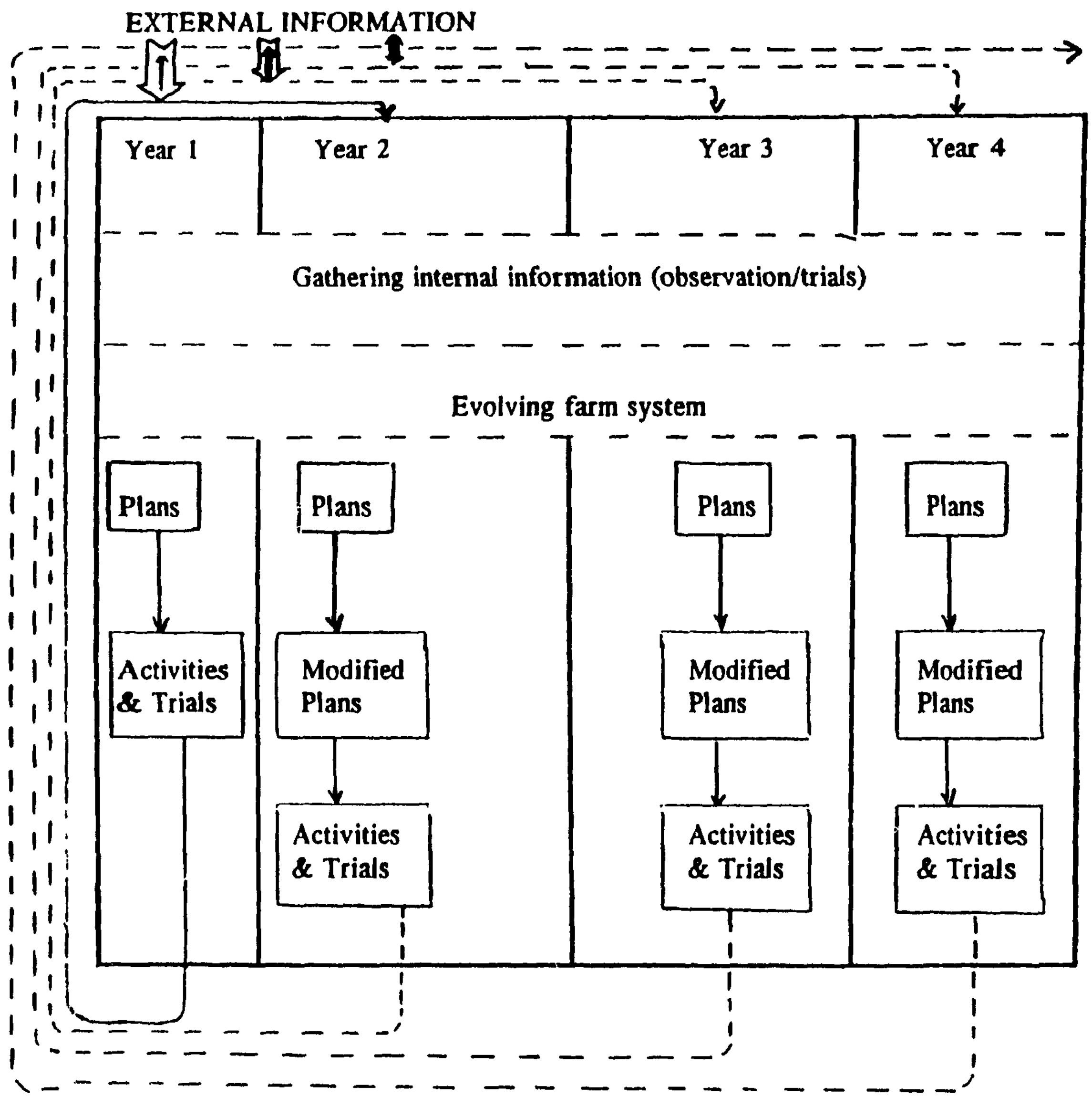
Three of the six farms (farms A,C,E) have taken a more systemic approach in the second year (Fig.12). They have developed site specific rotations designed to meet their on-farm needs, and promote rehabilitation within the system in terms of on-farm nutrient cycling/recycling, weed and pest control, and soil enhancement/conservation. These are ultimately aimed at long-term environmental maintenance, and biological and financial stability. The new rotations incorporate changes in fertility and manure management, cultural practices, and in some cases (farms A,C) changes in marketing strategy.

The time it will take to implement the complete rotation over the entire farm is dependant on site-specific considerations (e.g., current field/soil conditions; herbicide residues); the responses of various fields each year; the ease of acquiring new skills (e g., timing of field operations); and new information from outside and from within the system (Andrews et al., 1990; Doran & Werner, 1990; Lampkin 1990a, 1990b; MacRae et al., 1990b). Initial transition plans are, therefore, flexible and subject to adjustment A plan for implementing a new rotation (farm C) is presented in Fig. 13. All farmers have chosen to gradually withdraw synthetic inputs over the entire farm, with "cold turkey" on a minority of fields (or trial strips) that were judged capable of immediate transition. Criteria used in this judgement included a soil analysis, a soil profile examination (Soltner, 1988), a Bourguignon soil test (Bourguignon, 1990), the field's history (previous crops and herbicide use), the crop to be grown, and the farmer's experience with the particular field. Three farms (A,C,E) are progressing toward organic certification. It is not being suggested that certified organic farming is the equivalent to sustainable farming. The point, rather, is that the decision to meet the organic standards of certification, with the considerable restructuring this requires within the current system, demonstrates a significant and more demanding step being taken in the transition to more sustainable farming.

Changes on the three remaining farms (farms B,D,F) involve lesser adjustments to the present farming system. Reducing synthetic input use (fertilizers and herbicides) remain the primary objective. Whole-farm adjustments include some modifications of the current rotation, and fertility and manure management systems Trials (expanded on all six farms over year 1) comprise mechanical/cultural weed management, green manures, interseeds, and fertilization regimes.

A Conceptual Interpretation

Figure 18. Experience and Feedback - A Conceptual Interpretation.



Note. Varying arrow sizes under "External Information" illustrate that the need for external information inputs decreases with time; information output increases with time; external information inputs may eventually balance with information inputs.

Whether the farm is in transition (via organics) toward a sustainable system, or simply is in transition to a system less dependant on synthetic inputs, an important feedback mechanism appears to be at play (Fig.18) whereby:

1- Each year's experiences offer feedback that will modify the plans for the following year.

2- Seeking external (off-farm) information is a part of this feedback mechanism. This is particularly important in the early years when both ecological principles and alternative practices are "new" to farmers. It may take on a lesser importance in later years as these principles and practices become "known".

3- Internal (on-farm) information generation is a constant input to guide farm management throughout transition, its importance possibly increasing over time. (Also, it may become a valuable source of information for other transitional farmers within the region with similar circumstances. Small on-farm demonstrations in the first year may lead to increased and more diverse forms of farmer-farmer communication as the transition proceeds).

4- All of the above contribute to the evolution of the farm system.

Part 2: Farmer Profiles

The program of on-farm activities for year 1, which were confined largely to small-scale trials of known techniques, was expanded considerably on most farms in year 2 to incorporate systemic planning and include developments at the whole-farm level. Reasoning behind this progression, however, cannot simply be attributed to "linear" cause and effect phenomena, e.g., information + experience → increased confidence and motivation -> expansion of appropriate activities. Rather, it seemed to be a result of experiential learning, and cyclical patterns of action and reflection by the participants (Bawden et al., 1984; Freire, 1970; Kolb, 1984; Nault, 1991). This also led to an evolution within the "farmer profile".

In Section 1, this evolution is examined in terms of vision, creativity in planning and problem solving, and value adjustments. Section 2 focuses on the design principles used by the farmers in planning, and on the impacts of real and perceived restraining forces hindering the transition process.

These "farmer profiles" are presented to illustrate how each farmer's "habits of mind" may influence farm evolution toward sustainability.

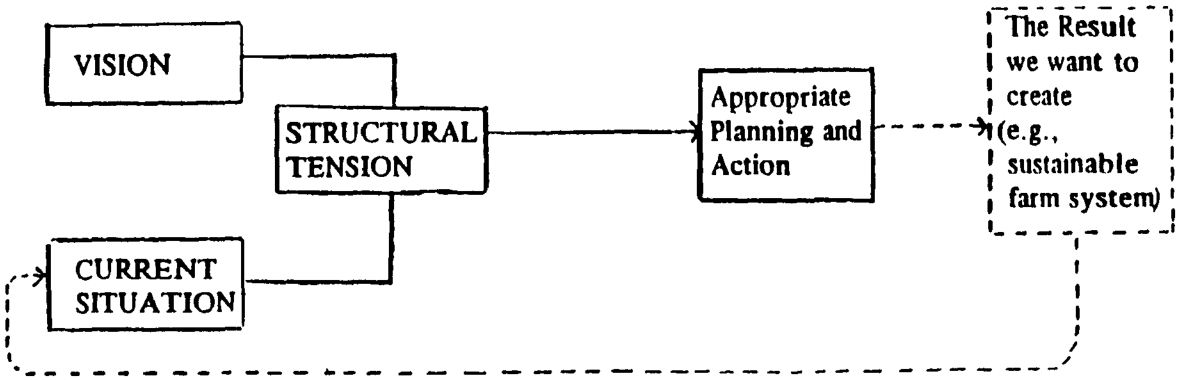
Section 1

Vision and Creative Approaches to Planning and Problem Solving

In Chapter 2 it was argued that a main driving force in the design and development of a sustainable system is the ability to envision a future, more desirable system (Brown et al., 1990; Fritz, 1989; Hill, 1980a, 1980b, 1991; Robinson et al., 1990; Savory, 1988). This preliminary vision, which serves as a starting point, evolves with time and experience. Reconciling the vision with the current situation, which must be clearly perceived, becomes the creative task of the "creator", in this case the farmer in transition. Fritz (1989) equates this reconciliation with acknowledging a "structural tension" (p.115) between the two, i.e., a discrepancy that seeks resolution. This discrepancy is considered a positive force. It contains the energy that enables the creation of the desired result, e.g., it enables the farmer to plan and act appropriately

Figure 19. Uniting Vision and Current Situation: The Creative Process of Planning and Action.

(Adapted from Fritz, 1989, p.115)



This conceptual framework (Fig. 19), which assumes that appropriate planning and action stem from the capacity to creatively seek resolution between a benign vision of a desirable future sustainable system and a candid acknowledgement of the current situation, served as the basis for commentary on the participating farmers' influence on the progression of their farms toward sustainability. A central question was, "to what extent can farmers express, during a facilitation process, a vision of a future, more desirable system?" Also, at this early stage of transition, what type of approaches are farmers using to seek resolution between the current situation and the system they hope to create?

Methodology

1- Individual meetings were held with each participating farmer. These combined semi-formal interviews with informal discussion. Answers to a previously completed questionnaire also served as a reference point at each interview. All responses were recorded as written notes. Two interviewer-researchers were present at each meeting.

2- During the interview, each farmer was invited to share his vision of what he would like his farm to look like - what results he would like to see - within the next several years. Time periods were left flexible and open to farmer comment. Each farmer was then asked to comment on his current situation, e.g., farm resources, relative strengths and weaknesses of each; priorities. Plans were elaborated for the upcoming season, and beyond (Fig. 12, Part 1). The current situation and possible plans for the upcoming season had been previously discussed and recorded as field notes. These also served as a reference and starting point. A main purpose of these "vision" meetings was to consolidate the farmers' plans.

3- The framework used for analyzing the farmers' responses was adapted from Hill (1980a, 1980b, 1986) and Fritz (1989), (Fig. 20). It consists of four categories that define a benign, sustainable vision (clarity, holistic outlook, time orientation, and psychological state), combined with two categories relating to (i) the creativity of the planning and problem solving approach, and (ii) the potential sustainability of the plans for the upcoming season, as influenced by the dominant problem solving strategy. Fritz's (1989) "10 methods of choosing" are included in Fig.20 as a useful guide for determining where farmers place the "power" of their choices. Each category is accompanied by a list of indicator

Figure 20. A Framework for Assesssing Vision and Approaches to Planning and Problem Solving (Largely adapted from Hill 1980a; 1980b, 1986; and Fritz 1989)

VISION

CLARITY

10	0
• clear	• unclear/confused
• specific/defined	• conceptual/general
• consistent/coherent	• piecemeal

HOLISTIC OUTLOOK

10	0
• holistic	• partial/component
• broad	• narrow focus
• interactive	• speciaized/linear
• hetergenistic	• homogenistic
• comprehensive	• fragmentary/incomplete
• changing/evolving	• unchanging/reactionary
• reflects awareness and concern for support systems	• narrow focus on farm resources

TIME ORIENTATION

10	0
• long-term & short-term	• short-term
• present (& future)	• past/future

PSYCHOLOGICAL ORIENTATION

10	0
• confident	• fearful/frustrated
• responsible	• irresponsbile/blaming
• gentle	• angry/violent
• open	• closed
• self reliant/self determination	• vulnerable/dependent
• rational	• irrational
• motivated	• obligated
• enthusiastic	• apathetic
• committed	• "only involved"
• hopeful	• desparate/apathetic
• inspired	• forced
• joyful	• depressed
• positive "what do I want"	• negative "what I don't want"
• comfortable with complexity	• uncomfortable/wary
• flexible	• inflexible

Continued

Figure 20. (Cont'd) **CREATIVE PLANNING AND APPROACH TO PROBLEM SOLVING**

Creative/Reactive Approach	
10	0
innovative (invention)	conservative (convention)
evolving	linear
pro-active	reactive
individual creativity	institutional culture
imagining more desirable futures	projecting from present trends/adjustments

Dominant Problem Solving Strategy (DPS):	
Sustainable	**Nonsustainable**
10	0
preventative (causes)	curative (symptoms)
complex	simple
- multiple	- mono-view
- symbiotic/synergistic cybernetic	- competitive/isolated
- nonlinear/cyclical/feedback	- linear/open flows/leakage
indirect	direct
bioecological/social	physio-chemical
knowledge and skills	technology and purchased inputs
unique local responses to unique local situations	patterns, packages, uniformity
long-term	short-term
conserving, harmonious	exploiting/dominating/consumptive
flexible	rigid/inflexible
evolving	degenerating

Fritz's Methods of Choosing

1. Choice by limitation (choosing only what is possible or reasonable).
2. Choice by indirectness (choosing process instead of result).
3. Choice by elimination (choosing the "remaining" option).
4. Choice by default ("choosing" not to make a choice).
5. Conditional choice (imposing preconditions on choice).
6. Choice by reaction (choice designed to reduce discomfort/conflict/pressure).
7. Choice by consensus (choosing what everyone else is doing).
8. Choice by adverse possession (based on hazy metaphysics).
9. Choosing negative results (choosing "what I don't want").

words and a numerical scale. These were used when recording the interviews.

Interviews were analyzed by associating farmer's responses to the indicators within each category, and then assigning a relative score on the scale. Because a fairly arbitrary starting point was chosen, scores are relative (i.e., comparable) within the group, but they do not reflect scoring against some theoretical sustainable or unsustainable focal point.

Results and Discussion

Results of the analysis are shown in Table 7.

Farmers differ in their capacity to envision future sustainable systems and in their approaches to planning and problem solving. For example:

- Farmer B has a fairly clear vision of a future system (score 7). However, both the vision and the farm plan appear otherwise weak in terms of potential sustainability (scores between 1 and 4).
- Farmer C has a clear vision of a future system (score 8), and a creative approach to planning and problem solving (score 8). Slightly lower scores in "holistic outlook" (score 6) and "sustainability" of the plan (DPS score 6) indicate that more progress could be made in these areas. Studying the list of indicator words for these two categories (Fig.20) may help the farmer recognize opportunities for enabling such progress.
- Farmer D does not yet have a clear vision for the future (score 2). Equally, approaches to planning and problem solving tend to be more reactive than

creative (score 3), and current plans do not reflect high levels of potential sustainability (DPS score 3).

The purpose of this exercise is neither to praise nor denounce farmers' visions and approaches to planning and problem solving as appropriate or inappropriate. Rather, the usefulness of the exercise lies in its potential as a tool for pinpointing areas where progress can be made.

It is up to each individual to respond as he wishes to such information. For example, all farmers received their lowest scores in the category "holistic outlook". This suggests a broadened, more systemic outlook would benefit the development of a sustainable farm plan. Similarly, all farmers received relatively lower scores in the "sustainability" category for their proposed plans. Indicator words within this category reflect awareness and understanding of the principles of sustainable systems. Results reflect, therefore, that to increase the potential sustainability of their planned future system, all six farmers may benefit by gaining a better understanding of these concepts.

Table 7. **Vision and Approach to Planning and Problem Solving: Interview Analysis Results**

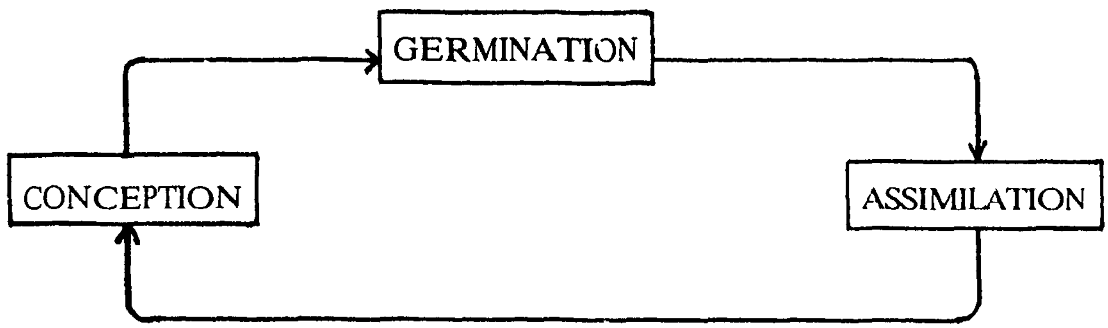
Farmer's Score

VISION	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**
Clarity			**C**	**B,E**		**A**		**F**	**D**	
Holistic Outlook					**C**	**E**	**A**	**F**	**D**	**B**
Time - Orientation			**A,C E**		**F**		**D**			**B**
Psychological State			**A,C**	**E**	**F**	**D**	**B**			
CREATIVE PLANNING & PROBLEM SOLVING										
Creative/ Reactive			**C**	**A,E**			**F**	**B,D**		
DPS: Sustainable/ Nonsustainable					**C**	**A**		**D,F**	**B,E**	

Fritz (1989) suggests that the following three stages are involved in the creative process, which is cyclical: germination, where we make choices about desired results, and where our methods of choosing reflect our level of empowerment/disempowerment; assimilation, where we ultimately embrace that which we want to create; this has an internal phase - embracing the creation inwardly - and an external phase during which as the creation expresses itself outwardly; and completion, the full and total accomplishment of the desired result. This is followed by new germination ideas and the cycle continues (Fig. 21).

Figure 21. The Threefold Stages of the Creative Cycle.

(Adapted from Fritz, 1989)



With respect to these stages, it was apparent that different farmers were at different stage in the creative cycle. For example, farmers A and C appear to be beyond the "germination" stage. Their ability to articulate a benign future vision and develop an appropriate plan based on the current situation places them at some point in the external phase of the "assimilation" stage. Results for farmer D, who was concerned with "choice" and experimenting with possibilities, suggest placement within the "germination" phase.

These two frameworks (Figs.19 and 20) are powerful tools for "situating" farmers - making clearer those elements of the farmer's profile (ability to envision, choose and plan effectively) that may ultimately affect the farm's evolution toward sustainability. These frameworks are here regarded as essential tools that could be further developed for effective extension in sustainable agriculture.

Value Adjustments

In Chapter 2 it was proposed that certain value adjustments within society will be required to develop sustainable societies and agricultural systems (Burkhardt, 1989; Hill, 1982,1991; Milbrath, 1989,1990; Savory, 1988).

Early on in the transition process, it is probably harder for farmers to admit to having made any conscious changes or adjustments in their values concerning (i) nature and (ii) society.

Methodology

In the aforementioned interviews, most farmers were asked to comment on (i) their relationship with nature, and if and how this has changed since their transition began, and (ii) their own role, as they see it, in society, and whether or not this has changed.

Field notes were consulted for supporting evidence.

Comprehensive frameworks exist that comprise a variety of quality of life factors and possible indicators of how each are valued within society (Hornback et al., 1973). The following simplified framework (Table 8) was used as a guide for analyzing farmer's responses. Farmer's statements and past field notes were scanned for examples that could easily be associated with the list of indicator words under each of the two broad categories (Table 8), and preliminary conclusions were drawn.

Table 8. A Framework for Evaluating Farmer's Value Adjustments With Regard to Nature and Society
(Adapted largely from Milbrath, 1989, 1990; Hill, 1980a, 1980b, 1991)

CHANGING VALUES AND BELIEFS:

With Regard To Nature	With Regard to Society
Respect for and valuing of natural systems	Generalized compassion toward other people and future generations (considerate of their needs)
Increased contact with and understanding of natural processes (learning about nature's processes and cycles)	Responsibility for quality of produce/environment/rural aesthetics
Supportive, harmonious, cooperative relations with nature	Cooperation/participation
Sensitive to needs of other species	Rural-urban linkages/farmer-consumer linkages
Recognition of natural limits	Self actualization and other quality of life factors
Actions limited by natural laws	Global equity and social justice
Ecocentric	Humanistic

Results and Discussion

Selected paraphrased statements (recorded during the interview session and supported by similar comments in previous field notes) are provided to illustrate the farmer's (1991) attitude to nature and society (Table 9). In most cases the statements have been translated from French.

The farmer's high level of participation in the project indicates that each harbours environmental concerns relating to current production methods, and is willing to take steps toward adopting more ecologically-sound methods. The purpose of this exercise was therefore, to explore farmer's conscious evaluation of their roles regarding nature and society beyond the farm gate, and to explore the related value adjustments that may have arisen over the past year.

At this early stage in the transition process, conscious value adjustments do not figure prominently. The need for more harmonious relationships with nature was mentioned by four farmers. All farmers alluded to their desire to be more conserving and less polluting to nature. Adjustments regarding societal values are not yet evidenced.

These results seem to support an emerging trend throughout the study. At this early stage in the transition process, an holistic outlook of a farming system supported by an environmental or natural support system and a social support system (Chapter 2, Fig.8) is not consciously acknowledged. Working with, and understanding of natural processes appears fairly elusive. Humanistic concerns appear limited to a responsibility for the quality of their produce and, in some cases, conservation for future generations, but not for the total environment and all of its

Table 9. Evidence of the Value Adjustments of the Participating Farmers (Paraphrased from Individual Meetings)

	FARM A	FARM B	FARM C	FARM D	FARM E	FARM F
NATURE	(N/A) In the past year I have learned that there is life in the soil and that we must live in harmony with it We have to learn to work with nature rather than exploit it.	I have environmental goals in that I do not want to pollute the land I work on However, not only is most of my land rented, but urban expansion and plans for industrial parks will have reached these lands within ten years. So, in my case, I will use this land more to my advantage, while I have it, being careful mainly about pollution, but not really soil conservation Nature is stronger than we sometimes think, with great capacity for regeneration, I don't think my current actions are too harmful	I would like to see more harmonious relations with nature Nature tends to balance itself if you don't destroy it (e g., foxes keep the woodchucks under control) However, sometimes this becomes a battle with society, because people around don't want to see the foxes! I have become much more aware of the negative effects of my own practices, such as Chemical fertilizer overuse, and am acting on this awareness Some of the things we do (e g , windbreaks) are more consciously done for the microclimate of our own crops still	Since the war, agriculture has become an industry, and we have lost respect for nature Eco-agr will slowly raise our awareness of nature But sometimes to produce we are fighting against nature Pollution from manure is something to work on	I'm moving towards a more harmonious relationship, one which is less exploitive, but I still profit from nature • My increased land in hay and trees are both conserving and aesthetic. The beauty of the farm is important to me	Reflecting back,we have been hard on nature to meet past goals of maximum milk production, and to maximize profit This is changing for us personally, and for agriculture in general. It isn't that hard to be friendly to the environment, it just takes that initial push. We have to work more with nature (e g , our attitudes towards weeds)
SOCIETY	N/A	N/A Importance of producing a high quality product	There is a need for changing values and attitudes in society as a whole • Farming/food production doesn't seem to be valorized by society We are following our chosen path more for our own self-satisfaction The aesthetics of the farm and preservation seems important to us, but I haven't <u>consciously</u> thought I was doing it for others coming into the future	The rural community has changed Before all events were planned around farmers work hours Now we are a minority - and in eco-agr even more of a minority • My role is to produce agricultural produce as best and as naturally as I can, even if it's not organic	I have windbreaks and will plant a small sugarbush this spring This in not just for myself, but for future generations	We want to produce a base product (milk) of the highest quality Also, I owe it to the environment and those coming in the future not to pollute my surroundings • Consumers want cheap food Also, people don't seem to expect farmers to have the same lifestyle/benefits/ quality of life as others This mentality has to change Farmers should be compensated if they are working longer hours • In agriculture generally, due to profits, aesthetics have never been a priority

<u>Note</u> • Indicates that the response was given after the researcher probed the farmer's outlook on his role in society as each of i) food producer ii) soil and or environment conservation for future generations, iii) upkeep of rural landscape aesthetics

N/A - Not asked in the interview

(Most responses have been translated from French) inhabitants.

Section 2

Design Principles

It was proposed in Chapter 2 that the stages of the transition process could be related to a spectrum composed of three sequential, overlapping stages: efficiency, substitution and redesign (Chapter 2, Fig.7). MacRae et al. (1990a) suggest that in the third "redesign" stage, the natural ecosystem and the ecological "laws" governing it may be used as a source of guidance for the design of sustainable agroecosystems. These ecological "laws" are presented in Table 10.

Methodology

The practices that were introduced by the participating farmers and their relationships to the "ecological laws" listed in Table 10 are given in Table 11.

Data sources included (i) field notes, (ii) workshop notes, (iii) interviews, and (iv) the farm innovation plans.

Results and Discussion

The main results of the analysis are presented in Table 12.

The farmers appeared to base their decisions on an awareness of both agronomic merit and environmental concerns, e.g., the practice is soil conserving and enhances soil life. They did not, however, appear to relate them to the ecological principles that underly the introduced practices.

Table 10. **The Four Ecological Principles ("Laws") of Nature In Relation to Food Production (Adapted from Commoner 1970; Hill 1976, 1981; MacRae et al.1990a)**

"LAW" OF NATURE	SOME WAYS IN WHICH OUR CURRENT FOOD SYSTEM CONTRAVENES THIS LAW
I - Survival is based on: Needs (food, space, shelter, clothing, education and other quality of life factors)	Much of our system is geared to supplying not real but manipulated needs
Availability of the resources on which they depend	Every stage of production and subsequent handling has become addicted to renewable resource inputs (particulary fossil fuels)
The incidence of mortality factors	Additional health hazards have been created with the industrialization of agriculture, e g , machines and toxic chemicals
II - Relationships in the environment are cyclical	The system is characterized by linear nutrient flows with their associated dependence on non-renewable resources and resultant pollution
III - Over time, natural ecosystems tend to increase in complexity, diversity, and resilience	An increasingly complex technology is used to manage more simplified ecosystems, e.g , - reduced gene pool - monocultures - removal of competitors - creation of uniform soil conditions - creation of uniform farm environment by specialization and removal of non-productive areas such as hedgerows, field borders, woodloots, wetlands. Solutions to problems deal primarily with symptoms.
IV - (a) All organisms are subject to certain biochemical constraints.	Production & processing are dependent on synthetic organic compounds that have no counterpart in nature (e g , pesticides, food additives).
(b) Natural ecosystems exhibit numerous benign self-regulating processes that if interfered with result in degeneration and dramatic population fluctuations.	Application of highly soluble nitrogen fertilizers inhibits symbiotic N-fixers. Pesticides kill natural controls.

Table 11. Relationships Between "Alternative" Agronomic Practices Adopted by Participating Farmers and "Ecological Laws"

Practices Employed/Planned by Participants	Supporting Agronomic Principles [a]	Underlying Ecological Principle (Natural "Laws")
Green Manures	• Organic matter accumulation/maintenance • Weed competition • Nitrogen fixation/fertilizer value • Stimulate biological activity • Improve soil structure/aeration/stability • Soil cover/minimize erosion • Recycling soil nutrients by serving as a sponge for manure spread	II, III
Corn Interseeds (a) Polebean/Soybean	• Increase protein content of silage/silage yield • Intra-row weed control	III
(b) Grasses/legumes/mixes	• Reduce soil compaction caused by wheel traffic at harvest • Soil cover/minimize erosion • Inter-row weed control • Possible fertility source (e.g. overwintering legumes)	III
Winter Cereals (a) Incorporation into cropping plans	• Fall/winter soil cover: reduce erosion, weed control • Quality and yield advantages over spring cereals	III
(b) Mixed stands	• Diversity of varieties: - less susceptible to env. stress and disease - compensatory effect/reduces effects of winter kill • Nutritional value	
Mechanical Weed Control (Corn, Soybean, Cereals) With herbicide elimination or reduction via banding	• Mechanical weed control (when combined with other cultural control practices) can be used to effectively manage weeds, and thereby reduce dependence on inputs of chemical herbicides.	I, IV
Crop Rotation	• Crop spatial and temporal diversity to: - maintain/enhance soil fertility, soil organic matter levels - enhance soil structure and soil biological activity - minimize weed, pest and disease outbreaks	II, III
Manure Management - Composting - Liquid manure aeration - Amounts/timings	• Effective recycling of farm nutrient resources • Improve biological, physical and chemical properties of soil • Preservation of nutrients, (reduce air and ground water pollution) / maintain and improve manure value • Stabilized nutrient content (increase nutrients in organic form) • Reduced toxicity/less hazardous to soil life • Nutrient balanced end product/reduced weed problems and pest infestation • Increased application options	I, II Continued

Rotational Grazing	• Soil quality/ecosystem diversity • Land use efficiency • Animal production efficiency • Increased length of grazing season	III
Fertilization Regimes	• Reducing fertilization via nutrient budgeting based on ploughdowns, manure inputs and soil contributions Fertilier equivalency of ploughdowns (hay/green manures/cover crops) and residual fertility of manure for three years is a valid, often ignored nutrient resource for crop production Nutrient budgeting can be used as a tool to guide fertilization programs and cut inputs of chemical fertilizers	I,II, IV

Note. Each practice, taken singly, was associated with the "Law(s)" to which it most relates A sustainable system will integrate a number of such practices The redesigned system will, therefore, reflect all of the ecological principles.

(a) Useful sources:

- Altieri and Liebmann (1988)
- Andres (1991)
- Berard (1989)
- Canadian Organic Growers (1990)
- Cramer et al. (1986)
- Francis and Clegg (1990)
- Germon (1989)
- Gunsolus (1990)
- Hansen and Henrikson (1989)
- Lampkin et al (1986)
- Lampkin (1990b)
- Martin et al (1987)
- Martin et al. (1991)
- Murphy (1987)
- Murphy (1990)
- Ott (1990)
- Parnes (1986)
- Petit et al. (1990)
- Samson et al. (1989)
- Soltner (1988)
- Voisin (1957)

Table 12. Participating Farmer's Decision-Making Based on Agronomic and Ecological Principles or Other Reasons (Number in brackets denotes number of farmers involved).

Practice Employed/Planned	Number of Farms Basing Actions on Some Combination of Agricultural Principles	Number of Farms Basing Action on Ecological Principles	Farms Basing Actions on Some Additional Criteria
Green Manures (5)	5	No evidence	Extended grazing possibility (1)
Corn Interseeds (3)	3	No evidence	-
Winter Cereal Survival (1)	1	No evidence	Important roles they serve in the overall rotation (1)
Mechanical Weed Control (4)	4	Negative effects of herbicides on soil microbes· relates to law IV(a) (general consensus)	Economics (reduce input costs) (general consensus)
Crop Rotation (4)	4	Merits of diversity evident, but more in relation to agronomic merit (i e , connection with ecological principles not overtly evidenced)	New market opportunities opening up (1)
Manure Management (5)	5	Treated (composted/aerated) manure seem to be less toxic to soil life· relates to law IV(b)	Basis with which to reduce particularly synthetic fertilizer and also herbicide use Economic implication (general consensus)
Rotational Grazing (2)	2	No evidence	Efficient use of an under used resource Cost effective means of raising steer (1)
Fertilization Regimes (2)	2	Fertilizers "doing the job of soil micro organisms" reducing their function and population numbers relates to law IV(b) (general consensus)	Economics (reduce input costs) (general consensus)

In workshop sessions (#4- On-Farm Trials, and #8- Soil Fertility and On-Farm Nutrient Cycling), farmers demonstrated awareness of various better-management practices and of many of the agronomic principles upon which they are based. Also, the concepts of "soil life" or "soil biological activity" were often mentioned. However, specific knowledge of what constitutes soil life (e.g., the main groups present and typical population densities of micro- and macroscopic groups, their functions and implications in soil cycles and processes), was lacking. This, and the absence of any direct reference to the ecological laws as presented in Table 10, gave evidence of the elemental level of the farmers' knowledge in this area. Comments on fertilizers "doing the job of microorganisms" (thereby reducing their need and number), and possible negative effects of herbicides on soil life, by implication perhaps reflects a preliminary awareness of law #IVb, (concerning self-regulating mechanisms and population fluctuations) and law #IVa (concerning biochemical limitations in nature).

The other main decision-making criteria related to economics or specific agronomic concerns, e.g., green manures to permit extended grazing.

In some instances the agronomic merit of certain alternative practices was known, but they were not being employed on-farm. This suggests certain real or perceived barriers are hindering their adoption. This question is examined in more detail later in this chapter.

The implications of these results are two-fold. On the positive side, the farmers were aware of many alternative practices and of their agronomic and environmental merit. All were interested in adjusting their current farming systems to integrate these practices. This is encouraging for the development of environmentally-benign, resource conserving systems.

However, their limited knowledge and understanding of natural, biological processes and of the ecological laws governing them could prove to be a barrier in the design and development of truly sustainable farming systems. Such systems are based on working with biological processes (soil nutrient and water cycles, natural energy flows), which are self-maintaining and self-regulating, and on building and maintaining this natural capital. Working with these biological processes necessitates an awareness of the processes themselves, and an understanding of the ecological principles governing them. This detachment from nature, and relative ignorance of natural processes, however, is common in our society and not confined to the farming community (Fukuoka, 1987; Freudenberger, 1986; Hill,1980a; Milbrath, 1989, 1990).

Efficiency - Substitution - Redesign

The efficiency - substitution - redesign (E-S-R) spectrum (Fig. 7, Chapter 2) is a useful model for estimating the potential sustainability of farmers' transition plans and actions. Because it is an evolutionary spectrum, we can expect adjustments that take place during the transition period to correspond to each of the three stages. Hill (1985) suggests that overemphasis on the first two stages and delay in reaching the third stage indicates that the necessary redesigns within the system are lacking. This hampers the potential evolution of the farm system - protecting and perpetuating the underlying cause of the problem, the maldesigned, malfunctioning agroecosystem.

In Fig. 22 the practices planned and adopted by the six farmers during the past 16 months have been listed along the E-S-R spectrum.

Results and Discussion

During the first year of the transition process, all six farmers adopted practices that allowed them to reduce their dependence on synthetic fertilizers. These practices were based on improving efficiency of resource use and expanded reliance on internal resources (e.g., improved manure management) and substituting locally available resources (e.g.,leaf compost; leguminous green manures). With cost and environmental incentives (e.g., reducing pollution in groundwater, reducing toxins in soils that may inhibit soil life) in mind, most of the farmers reduced herbicide use by substituting cultural and mechanical weed management strategies. This reduction in synthetic inputs probably allowed the farmers to capitalize on underused internal resources by permitting repopulation of beneficial soil organisms (e.g., nitrogen-fixing bacteria; earthworms) that had been reduced by the synthetic inputs. Other efficiency strategies (e.g., herbicide and fertilizer banding) and substitutions (e.g., wind-powered water pumps to replace hydroelectricity) were also introduced on some farms.

Redesign strategies were evident on those farms that adopted new, more complex rotations (farms A,C), thereby increasing the spatial, temporal, and functional diversity of their systems. Some "prerequisite" steps prior to redesign included trials of winter cereals and intercrops. More diverse crop rotations were

Figure 22. Relating Farmers Adopted/Proposed Practices to the E-S-R Spectrum
(Adapted partially from Hill 1985, 1990a, 1990b, 1991; MacRae, Hill, Mehuys, & Henning, 1990)

E-S-R SPECTRUM	FARMER'S PRACTICES
EFFICIENCY - Do the same things more efficiently	- **Manure Management** (add more straw to absorb liquids; storage methods; timing and amounts spread; liquid aeration) - **Herbicide Banding** - **Fertilization Regimes** (avoiding excessive fertilization via nutrient budgeting; fertilizer banding and timing)
SUBSTITUTION - Replace environmentally disruptive inputs with environmentally benign ones	- **Green Manures** (replacing synthetic fertilizers with leguminous green manures; sponges on which to spread FYM; weed management replacing herbicides - **Manure Management** (replacing synthetic fertilization with FYM, particularly in the form of compost, aerated liquids, or composted locally available by-products (leaves)) - **Cultural/Mechanical Weed Management** (replacing synthetic herbicides with cultural practices (e.g., delayed seeding dates) combined with mechanical operations (e.g., primary tillage, Lely, rotary hoe, cultivation) - **Wind Powered Water Pump** (to replace hydroelectric power in bringing water to the barn) - **Intercropping** (has substitutive role in weed competition, but is moving towards redesign with its benefits of diversity and soil rehabilitation) - **Winter Cereal Mixes** (efficiency - yield and crop quality advantages, soil cover; substitution - weed control)
REDESIGN I - Design and manage systems to prevent problems and achieve sustainable goals - Requires a heightened level of awareness, appropriate skills and information, acting in present rather than past, institutional supports - Incorporates ecological and economic diversity - Locally unique - Self reliant - Working with natural products, processes, and cycles to achieve optimum ecosystem function	- **Crop Rotation** (incorporating diversity in space, time, and function) - **Rotational Grazing** (efficiency role of making use of a previously under-used resource (permanent pasture); substitutive role as animal feed replacing concentrates; but also redesign function in the long-term, as its importance with the farm system increases (i.e., important role in projected production/management options for the future, e.g., incorporating cow-calf enterprise))
REDESIGN II - Design and manage systems to prevent problems to achieve sustainable goals - Reconstruction and maintenance - Based on heightened awareness and understanding of ecological principles and on human psychosocial evolution - Continually evolving/Developments in the science and art of agroecosystem design and management	

EVOLUTION

planned depending on the results of the first year's experiments.

At the early stage, efficiency and substitution strategies figured more prominently than redesign strategies. This is because the first two stages are easier to implement, and can be considered as logical first steps. However, to achieve long-term sustainability within the farm system, more effort will have to be invested in redesign possibilities. Action must be taken on all levels. Hill (personal communication 24/01/91) suggests that redesign ultimately involves getting in touch with "who we really are", our beliefs and values, and our level of personal empowerment. This can be a difficult (though ultimately rewarding) process. It involves overcoming psychological rather than technological barriers (Hill, personal communication, 24/04/91).

Redesign for sustainability goes beyond just increasing the complexity and diversity of the farm system (and all of the management and marketing adjustments this entails). It requires an evolution in our (both farmers' and scientists', and ultimately society's) understanding of ecological processes and principles, an expansion of our awareness of reality, empowerment and psychosocial development (Hill, 1991).

Restraining Forces Inhibiting Transition

The transition from current systems requires overcoming those limiting factors that are perceived to be, or are, effectively hindering the process. A practical guide to transition published by Rodale (undated) lists five principal categories of such barriers, namely: biological, informational, managerial, socioeconomic and political. Various authors have treated these generally or have concentrated on a particular limiting factor (Andrews et al., 1990; Blobaum, 1984; Hanson et al., 1990; Hill, 1985, 1986,1991; Hill & MacRae, in press; Kirschenmann, 1988,1989; Lampkin, 1990a; MacRae et al., 1988; MacRae et al., 1989: MacRae et al., 1990b; Vail, 1987).

Successful transition may be facilitated by strengthening the driving forces and weakening or removing the restraining forces (Hill, 1985; Lewin, 1947 (1982)). In the present study it was felt to be important to determine the main barriers that are present for farmers in the early stages of the transition process.

Methodology

A framework for analysis was drawn up based on the five previously mentioned categories of barriers (Rodale Institute, undated). Three sources, including (i) field notes, (ii) a written questionnaire, and (iii) individual interviews provided the data on the farmer's perceived and real barriers (Table 13). Various driving forces and opportunities mentioned by farmers are also included in the matrix. However, more emphasis was placed on determining those factors that are likely to be most significant in hindering the transition process for the six participating farmers.

Table 13. Driving and Restraining Forces Mentioned by the Six Participating Farmers

Driving/ Restraining Force		FARM A	FARM B	FARM C	FARM D	FARM E	FARM F
BIOLOGICAL	R	●Soil drainage/ compaction ●Soil fertility ●Herbicide residues	●Weeds ●Weather (hard to produce high quality hay - therefore limits amount in rotation)	●Weather (e g winter kill) ●Soil drainage in one field ●Herbicide residues	●Weeds ●Weather (e g , winter kill) ●Soil fertility ●Herbicide residues	●Weeds	●Soils (e g , heavy clays, poor drainage) ●Weather (e g , winter kill) ●Quackgrass
	D	● Manure	●Leaves for composting ●Rich soils	● Animals	●High soil organic matter ●Manure	●Earthworms	●Rotation ●Manure ●3000 heat units
MANAGEMENT AND SKILLS	R	● 2 farm managers ●manure storage (lose liquids) ●Weed control ●Composting ●Inadequate storage facilities for new crops ●Possible labour bottlenecks	●Timing of operations (weather) ●Time required for observations (change habits)/possibly increased work load ●Lack of rotation leads to poor soils	●Liquid manure management ●Weed control (in cereals) ●Timing of operations (weather) ●Contracted manure spreading ●Availability of crop varieties ●Machinery calibration for new crops ●Certification (losing land to borders)	●Manure management ●Timing of operations (weather)	●Manure management ●Composting -space -equipment -management -straw storage	●Manure management ●Corn manuring ●Weed management ●No grain bins ●"Complete ration" system
	D	●Eventual labour reductions (e g , reduced tillage systems)	-	●Successful weed control with later planting dates	-	-	●Outcomes of previous experimentation (e g , manure management, windbreaks, reduced tillage cover crops)
INFORMATION	R	●Lack of information (e g , soil fertility) ●Formal trials difficult to set up	●Lack of information ●Receiving prescriptions and "recipes"	●Lack of information (e g , liquid manure management) ●Some formal trials difficult to set up ●Lack of knowledge and experience of the agronomes	●Lack of information prior to 1990 (e g manure, from Quebec-specific trials)	-	●Lack of information on ecological agriculture ●Fitting general information into our particular farm system
	D	●P OFR ●Resource person ●Networking with other farmers	●P OFR ●Production club ●Resource person	●P OFR ●Resource person ●Networking (farm visits/field trips)	●P-OFR (=motivation) ●Resource person ●Practical simple information as of 1990	●P-OFR ●Production club ●Resource person	●P OFR ●Some information as a stimulus

Continued

Table 13. Cont'd

Driving/Restraining Force		FARM A	FARM B	FARM C	FARM D	FARM E	FARM F
POLITICAL/ INSTITUTIONAL	R	• Finding markets	-	• Stabilization insurance versus cattle on pasture	-	• Minimum acreage necessary for some subsidies	• Stabilization programs do not favour rotation over monoculture
	D	• Green manure program • Erosion program (e g , wind breaks) • Emerging organic market opportunities	• Program for production club	• Green manure program • Subvention for feed lots	• Green manure program	-	• Programs for windbreaks drainage and levelling
ECONOMICAL	R	• Some green manures are costly • Poor barley prices (affects rotation economics)	• Rotations are not economically advantageous • Importance of short-term economic feasibility	• A "challenge" that is problematic for awhile • Some green manures costly	• Fear of yield decline (economic impact) • Some green manures costly	-	-
	D	• Possibility of reducing input costs	• Overall economic incentive - reducing input costs	• A "challenge" that is attractive for the future	-	• Possibility of reducing input costs	• Possibility of reducing input costs
PHYSCHOSOCIAL	R	-	• Urban encroachment and industrial expansion taking over rented land (no incentive for preservation)	• Some social norms aren't advantageous (e g kill foxes, get woodchuck problems) • Farms/food production not valued by society generally	• Changes in rural community structure (e g no longer a collective spirit Farmers are a minority) and eco-farmers even more so)	-	-
	D	• Networking is leading to greater confidence and inspiration	• Idea of producing better quality produce/less pollution to environment • Increased understanding of soil and systems	• Increasing confidence and determination	• Increasing motivation • Experimenting changes mentality via eco-agr	• Realizing I'm not as "bad" as some others • Confident and happy with direction being taken • Growing awareness that organic is possible • Importance of land preservation for future generations	• Through networking we see that other ways are possible and that we can improve

Note R = restraining force, D = driving force, P-OFR = participating on-farm research

Results and Discussion

The factors that each individual farmer regarded as limiting to his transition are listed in Table 13. Most farmers noted restraining forces in most categories. Lack of management and other skills were mentioned most frequently. Social and psychosocial factors were rarely mentioned.

Although each case was clearly unique, some common factors can be recognized. The following restraining forces were mentioned most often: manure management (six farms); weeds/weed management (six farms); timing of operations either due to conflicting demands on labour (one farm), or difficulty to synchronise an activity with the appropriate weather conditions (three farms); lack of appropriate information (six farms). Information generation via participatory on-farm research was mentioned as a potential driving force or solution by all six farmers. Economic factors were judged to be both restraining forces (four farms) and driving forces (via reducing input costs)(five farms). Social and psychosocial driving and restraining forces are more difficult to determine. Given the open-ended nature of the questioning, farmers tended to comment much less on these aspects compared with the other categories. Several did, however, mention an increase in confidence and motivation since the transition began (four farms).

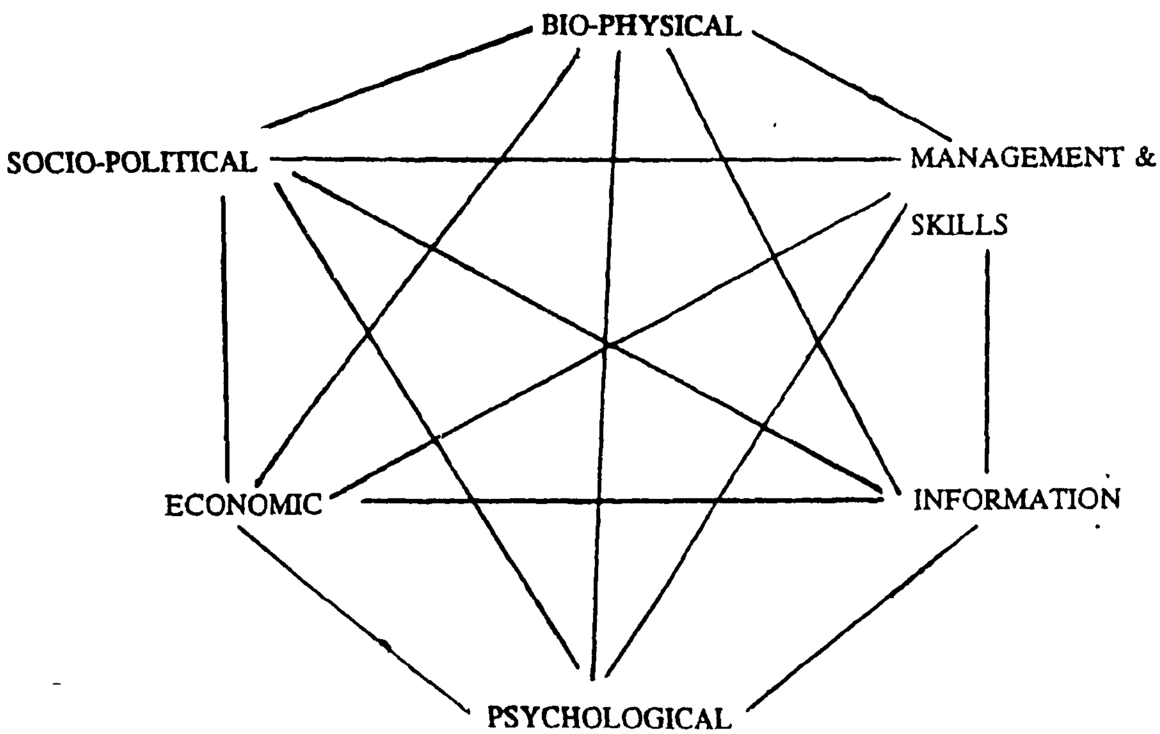
Some factors, such as manure management, were regarded as both driving forces (e.g., an opportunity to recycle on-farm nutrients), and restraining forces, e.g., how to solve the problem of managing the manure most efficiently within the current farm structure?

Reality is complex and multiple. Andrews et al. (1990) suggest that the barriers to creating productive and sustainable farm systems fall into three <u>interrelated</u> categories: 1- biological, 2- informational and managerial, and 3-socioeconomic and political. Because of such interrelations, "categorizing" particular restraining forces can be difficult. Take, for example, a farmer who says "weeds" are a real problem hindering transition. This can be considered 1- a biological problem of excessive weed population numbers due to certain unfavourable field characteristics; 2- a management problem of how to prevent such infestations given the vagaries of weather and the need for accurate timing of field operations; 3- an informational problem, such as lack of information or misinformation concerning weed life-cycles and working with these to develop a sound rotation; 4- an economic problem, where a particular piece of machinery (such as a rotary hoe) is deemed necessary, at least in the short-term, but for which the capital is lacking; 5- a political problem in that current policies favour monocultured corn over more diverse rotations, thus favouring weed outbreaks; 6- a psychosocial problem, based on fear, whereby the problem is envisaged to be more serious than it really is and herbicides are considered a powerful and "safe" way of eliminating weeds, fulfilling some more deeply rooted security need of the individual.

Though some interlinkages are much clearer than others, the amalgam of driving and restraining forces can be pictured as in Fig. 23.

Contrary to more common linear / analytic models, where elements are isolated and treated one by one, in this model (Fig.23) a systemic outlook (de Rosnay, 1979), which considers the importance of interactions among potential driving and restraining forces, is proposed. Strengthening a driving force or weakening a

Figure 23. The Complex of Interrelated Driving and Restraining Forces.



restraining force in one category may have multiple positive or negative effects in other categories. Such an awareness is helpful when planning the transition to a sustainable agriculture.

CHAPTER 4: A PRACTICAL STRATEGY FOR FACILITATING THE TRANSITION PROCESS

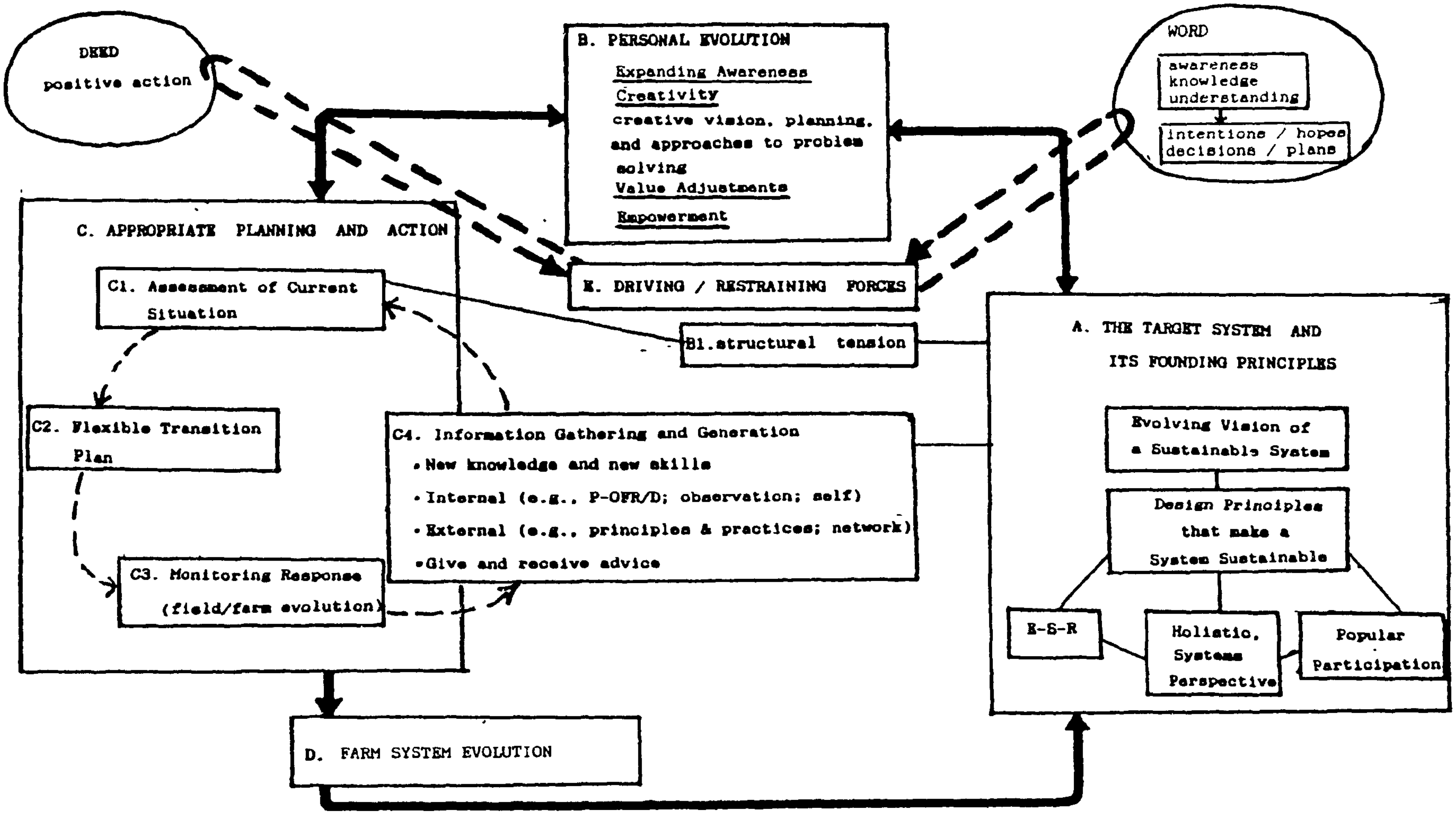
In Chapter 2 a theoretical model for managing the transition process was constructed (Fig. 10). It was designed to overcome the weaknesses of the current "popular" framework for transition planning. Six farms in transition were then followed for a 16 month period. Information gathered from these farms was then used to expand and redesign the theoretical model.

In this chapter these findings are presented in the form of a practical strategy for facilitating the transition process. This strategy combines the theoretical foundations with the realities of on-farm planning (Fig.24). The usefulness of this model lies in its role as a planning template for farmers in transition and the extension personnel working with them. Ways to use the model are presented in Table 14.

<u>The Model and Its Construction</u>

The model comprises five main components. These are (A) the target sustainable system (i.e., the vision), and its founding principles; (B) personal evolution; (C) appropriate planning and action; (D) the evolving farm system; and (E) the complex of driving and restraining forces. Each of these components has been examined in previous chapters. These components are assembled into a series of three interconnected evolutionary cycles, or feedback loops (Fig.24). These have been termed the main, the inherent, and the planning/action feedback loops.

Figure 24. A Practical Strategy for Facilitating the Farm Transition Process: Combining Theoretical Foundations with Insights Gathered on Six Transitional Farms



Note. —— =link; ——> =flow. ➡ =Main Feedback Loop; ▬ ▬➔ =Inherent (word-deed) Feedback Loop; - - -> =Planning/Action Feedback Loop

The main feedback loop

The main feedback loop comprises the four main components (A) envisioning a target system based on the founding principles of sustainability; (B) evolution within the personal profile, which influences and is influenced by awareness of these design principles (thus the double-headed arrow); together leading to (C), appropriate planning and action; which in turn influences the development or evolution of the farm system, (D). Two reinforcing links strengthen the connection between (A), the target system, and (C), appropriate action. The first, (B1), is the structural tension between the vision and the current situation that must be resolved. The second, (C4), is information gathering and generation.

The inherent feedback loop: The word-deed cycle

The inherent feedback loop, or word-deed cycle, must be visualized in three dimensions, encompassing the entire strategy. The area to the right of the central axis - Word - (awareness, knowledge, understanding, and their influence on intentions, hopes, decisions, and plans), includes all the cognitive and reflective aspects of the strategy. The area left of the central axis - Deed - refers to the process of taking positive action based on this awareness. The inherent feedback loop is, therefore, the continuous cycle existing between word and deed. Awareness leads to responsible action, the results of which enhance awareness. This cycle is similar to the action-reflection cycle that Kolb (1984) claims governs all experiential learning.

On any farm, the unique pathway around the cycle is the result of interactions between the complex of driving and restraining forces presented in Chapter 3

(Fig.23). If awareness / intentions (Word) does not translate into action (Deed) on-farm, the complex of driving and restraining forces must be examined and the former stregthened and the barriers weakened or removed. For example, why is a rotation of known agronomic and environmental merit not being adopted? Similarly, if actions being taken on-farm do not seem to reflect awareness or understanding of sustainable principles, forces hindering reflection and understanding must be probed. For example, is the individual receiving misinformation; interpreting internal information incorrectly; or is the individual ignoring this information entirely, and perhaps reacting in a conditioned way? (Fritz, 1989; Hill, 1991; Jackins, 1965).

The planning/action feedback loop

Of lesser magnitude, an important feedback loop exists within (C), appropriate planning and action. This cycle comprises (C1) assessing the current situation, (C2) developing a flexible transition plan, (C3) monitoring the responses within the system as the plan is implemented, and (C4) continually gathering new internal and external information. This leads to reassessment of the situation, modifying the plan, and so the cycle proceeds.

This cycle comprises all of the elements of the popular framework presented in Chapter 2 (Fig. 5). The challenge, particularly in the early phase of transition, is to avoid focusing all one's attention on this loop, to the expense of the larger strategy. This may be tempting because of its practical and technical orientation.

The Strategy In Practice

The model (Fig.24) is proactive, being designed to ease the transition process. Details of how to use the model in practice are provided in Table 14, using the experience of the six participating farmers as examples. Also included are projections of how this approach might be expanded in the future, and details of strategies for its implementation. The primary focus is the "farm-level", with on-farm procedures for farmers in transition and extension personnel working with them as allies. It is understood, however, that to achieve a genuine sustainable agriculture, additional changes will be required beyond the farm gate, for example in government and research institutions, and within society as a whole.

Step 1: Determine the farmer's starting point

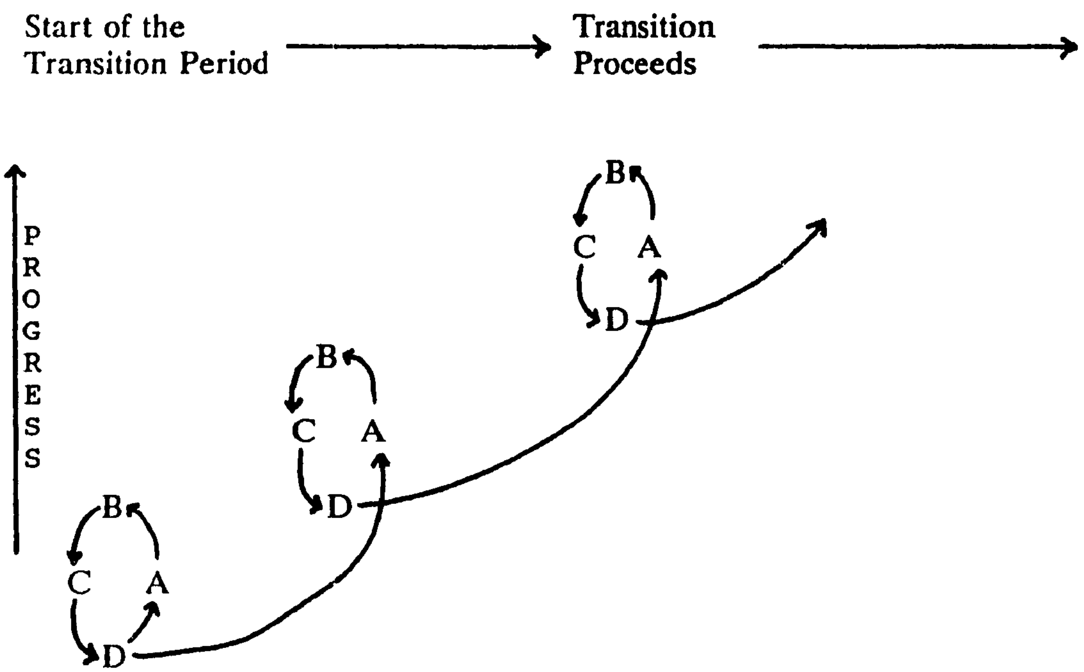
The strategy is cyclical and continuous (Fig. 25). Individuals may initiate their transition process at varying points within the cycle. The particular point chosen may be influenced by factors such as past experiences, individual and family values, and levels of awareness.

Locating the farmer's starting point requires sensitive interaction between the extension agent and the farmer and farm family, and reflective introspection by the farmer.

Extension Agent

In the initial visit(s) with the farmer and farm family, the extension agent collects preliminary background information on the current farming system. A simple data sheet can be prepared including headings such as type and size of farm enterprise(s), main soil types, current and past cropping systems, manure management system, characteristics of the animal production enterprise such as herd inventory, ration and requirements, health status, etc.

Figure 25. The Cyclical Nature of the Practical Transition Strategy.



Note. A = The Target System and its Founding Principles
B = Personal Evolution
C = Appropriate Planning and Action
D = The Evolving Farm System

It is useful to tour the farm as part of this data collection procedure, and to gain the confidence of the farmer and to start to work as a team. To achieve this collaboration requires that the extension agent develops to full potential his/her capacity as a facilitator. Some characteristics of a good facilitator include humility, honesty, openess, respect for and appreciation of farmers' indigenous knowledge and experience, capacity for mutual exchange and mutual learning, and willingness to work within a relationship of "partnership" rather than one of "expert/client".

Other key questions to ask at this time are: what experiments have and are being tried on-farm, how and why; what types of alternative practices and systems is the farmer aware of, and why they may be of interest? The farmer can be asked for his definition of ecological and sustainable agricultural systems, and if he has ever visited any such systems.

Some individuals may be ready to discuss in more depth their longer-term goals, specific objectives, and their hopes and expectations regarding transition. For others, however, these will only become apparent as the farmer-extension agent relationship solidifies and trust builds up.

At this early stage, the extension agent should estimate where the farmer seems to be situated in the main cycle (Fig. 24): whether he desires to probe the principles of sustainable farming, perhaps through a course or selected readings (A), desires to probe his motivations, personal goals, or other "self" factors (B), or desires to take immediate action (C).

Farmer:

Reflective introspection is required from the farmer to determine in which category he feels comfortable initiating his transition process.

Extension Agent and Farmer:

From the start, it may be helpful if both the farmer and extension agent become active participants in a support group such as a "Production Club" for transitional farmers within the region. Interaction with like-minded individuals is an important motivational and inspirational factor enhancing the transition process (Kirschenmann, 1989).

Francis (1990b) suggests that the future agenda for extension should focus on systems rather than components; efficient use of resources; information as a key production input; participatory systems for developing information; process rather than products; and community as well as farming and ranching. However, the support group, effectively a collaborative interface between farmers and extension agents, could be the better forum for promoting this agenda. Ideal characteristics of a support group are listed in Fig.26.

Step 2: Following the model

Once the farmer's starting point has been determined, transition can proceed according to the stages indicated in the model.

In the present study, the six farmers were judged (in retrospect) as having started transition by focusing on phase C, planning and action, particularly immediate action in the form of informal experiments of alternative practices.

The illustration of how the strategy is used (Table 14) begins, therefore, with phase C, appropriate planning and action.

Figure 26. Characteristics of a Support Group.[a]

Farmers	→ Interface ←	Extension Agent
	↓ THE SUPPORT GROUP	

Roles of all participants:
Cooperation
Collaboration
Consultation
Colleague

THE SUPPORT GROUP

- nonhierarchial nature of information generation and sharing
- active participation by all members

Motivation
Inspiration
Proaction
Sharing of information, data, experiences
Replication (e.g., of trials)
Generation of locally relevant information
Response to the unique questions and concerns of the group
A broadened focus (systems' interactions)
Common goals, shared agenda, reliance on one another for optimum success
Decision making by farmers
Revalorization of indigenous knowledge and experience
Communication between farmers and possibility of cooperation within the farming community
Uniqueness of group character (group develops in response to the needs, objectives, priorities, and strengths of its members)

Group Activities:

Open-ended group discussion
Workshops/focus sessions
Winter short courses and training for farmers
Farmer-initiated research (on-farm demonstration/ trials/P-OFR)
Farmer hosted farm field days
Farm tours and other visits
Networking (formal/informal/public and private sector/ regional)
Joint grant proposals (farmer & extensionist & researcher)
Linkages with consumers/larger rural and urban community
Model sustainable farm systems for the region

Note: [a] Useful sources in the compilation of this table included among others, all those sited in Fig. 3; Francis et al., 1990; Kirschenmann, 1989.

Table 14. **The Practical Model: Procedures for the Early Transitional Stage and Projections for the Future** '
(Based on the experiences of the six participating farmers, whose starting point was C - Appropriate Planning and Action)

Early Transitional Stage	Later Transitional Stages (includes projections)	Comments: - requirements/projections
C - APPROPRIATE PLANNING & ACTION **C1 - Assess the Current Situation**		
(i) Gather background information via farmer - extensionist meetings **Farm Inventory:** ●Farm resource inventory (soil, biotic, climatic, physical, human factors) ●Field history & field survey (crops, yields, soils, residues, weeds/pests, microclimatic and other particularities, farmer experiences with the field) ●Scale map (topographic features, roads, services, buildings, lanes, ditches, woodlots, water courses, wetlands) ●Current rotation (crop sequence, inputs and manure allocations, tillage) ●Areas of weakness (rills, gullies, erosion, compaction, poor soil quality, weed infestations, current labour bottlenecks, other insecurities) ●Animal production enterprise (herd inventory, health, feed requirements, management system) ●Current/past farmer experiments **Farmer Profile** ●initial motivations and objectives, areas of interest, past experience (ii) Identify alternatives (anticipate areas of weakness and plan accordingly) (iii) Farmer and extensionist become active participants in a support group (Fig 26)	●Define personal, family and business goals ●State particular objectives with some time estimates ●Elaborate long term goals ●Compare current situation with vision of a desirable future. Acknowledge "structural tension" between the two ●The current situation is reassessed after each field session.	**Requirements**. ●Extensionist/farmer develops simple checklists, inventory sheets, "self-tests" ●A file is kept for/by each farmer

Continued

Table 14. (Cont'd)

Early Transitional Stage	Later Transitional Stages (includes projections)	Comments: - requirements/projections
	C2 - Elaborate a Flexible Transition Plan	
•May begin with on-farm experimentation focusing on alternative practices/systems - define objectives of trials - implement on a small acreage (choose field, layout, methods, monitoring procedures and record keeping)	•Shift outlook to whole-farm planning (Broaden the focus from techniques and practices to restructuring and redesigning the farm system) •May require. - Designing a new rotation - Soil cover check (Fig 14) - Nutrient budget - Ration reformulations •Other related adjustments. - fertility and manure management - weed/pest management - livestock management - financial provisions - market adjustments, etc •Estimation of performance goals, identification of specific improvements and objectives; tolerable risk. •The whole-farm plan is adjusted each year in light of new information, experience, field response, and system response	Requirements: •Flexibility (as progress is made, the current system, objectives, technologies, markets, etc will change New issues and options will arise The farm plan must be responsive to these new developments) •Site specific planning (each farmer will develop unique plans suited to his/her own situation) •Simple plan-record sheets (e g , Fig 13, Fig. 14) become more elaborate to incorporate the managerial options of varying field circumstances •Though initially working together, farmer will eventually take over full responsibility for planning He must be involved in all phases of planning and calculation from the start if this autonomy is to be achieved

Continued

Table 14: (Cont'd)

Early Transitional Stage	Later Transitional Stages (includes projections)	Comments: - requirements/projections
C3 - Monitoring Response		
•Gather and interpret internal information •Farmer keeps records (what was done, how, why, confounding factors encountered, observations, results, completed objectives) •Some of the more easily obtainable data include - Yield/biomass production (sampling within and outside trial strips, weigh wagons, combine monitors) - Cost analysis - Soil evaluations (lab analysis, soil profile evaluations (Soltner, 1988), simple on-site soil tests (Bourgignon, 1990) Tissue analysis - Qualitative field observations - crop quality, growth, development - weed, disease, pest incidence - ease of working the soil - silting ditches/erosion, etc •Always carry a notebook •Take slides throughout the season •Extensionist will likely help in monitoring during early transitional phase, particularly if "Randomized, Replicated Strip Trials" are employed (Janke, 1984, Janke et al ,1990; Rodale Institute, 1990)	•Gather and interpret internal information •Evaluate progress at the system level The total program is evaluated annually. (Have expectations been met? What modifications are required in light of new information, experience, field and systems responses?) •Monitoring should expand in light of new awareness of critical indicators •Means of monitoring ecological impacts and social criteria must be developed •Economic analysis should expand to include cost/benefit on "non-market goods"	Requirements: •The main criteria for evaluating farming success have traditionally been production and profitability. Effects on environmental and social support systems have been neglected. •It is necessary to develop, refine and verify. - criteria for evaluating progress toward sustainability that include environmental and social criteria - simple means of evaluating and monitoring these criteria on-farm - field indicators (e.g , soil nitrate test kits, infiltration tests, biological activity kits, etc). •Farmers must develop their "bio-literacy" (Andrews et al, 1990, p. 292), i.e., become aware of the subtle effects of farming systems

Continued

Table 14. (Cont'd)

Transitional Stage	Later Transitional Stages (includes projections)	Comments: - requirements/projections
	C-4 Information Gathering and Generation	
1 **External Information** ●Network with a wide range of information sources ●Attend farm field days and farm tours (witness alternative practices and sustainable systems first-hand) ●Extensionist prepares fact sheets of locally relevant information ●Interactive workshops and focus sessions for farmers and extensionists and researchers and other interested community members ●Extensionist brings in outside information to stimulate critical thinking 2. **Internal Information** Generation ●On-farm experimentation (P-OFR/D), demonstration plots, trial fields, replicated strips ●observations on-farm Dissemination. ●Farmers host farm field days ●Make videos on participating farms ●Take slides throughout season ●Farmers share experiences within support group, with neighbours, within the community ●Extensionist prepares fact sheets based on participating farmers' experiences ●Extension agent should - Facilitate information exchange within the support group and with other formal/informal networks - Interphase with the larger support system to assu.. adequate resource availability, information flow, and feedback - Avoid info-glutting, sort site-relevant information - Support decision making by farmers, avoid recipes - Encourage strong team endorsement within the support group - Help in field scouting and sampling as necessary	●Extensionists and farmers prepare news releases ●Extensionists and farmers prepare fact sheets based on their experiences ●Advisory services build up their data bases based on systems and techniques developed/tested locally ●Farmers demonstrate innovative practices to the local farming community/larger rural community, and serve as local models of sustainable innovation ●Farmers' contact with the informational network solidifies ●Within the support group, everyone becomes a developer and a user of new information (non-hierarchial information sharing)	**Requirements:** ●Develop methodologies for gathering, generating, disseminating state-of-the art, locally-relevant information ●Training for extensionists ●Short courses for farmers. ●Practical manuals/handbooks with a local focus ●Development/endorsement of local P-OFR/D organizations ●Extensionists must integrate the practices and values of sustainable agriculture into mainstream extension meetings, publications, and back to the research sources ●Regional communication networks with - computer data bank connections - regional farmer-input - telephone hotlines ●Micro computer based farm-decision support systems are being developed which integrate critical ecological and economic dimensions of sustainability into a single farm planning process They do not generate recipes, but are used as a tool to facilitate farm planning and management (Ikerd, 1990)

Continued

Early Transitional Stage	Later Transitional Stages (include projections)	Comments: Requirements/projections
D - THE EVOLVING FARM SYSTEM		
•Farm/farmer evolution begins as soon as transition is initiated	•The farm develops and evolves toward sustainability •Concept of the farm as a system influencing and influenced by an environmental and social support system emerges	<u>Requirements:</u> •Revaluation and revitalization of the rural community • **Revaluation** of quality of life factors for the farming community depends, ultimately, on the development of a sustainable society
A - THE TARGET SYSTEM AND ITS FOUNDING PRINCIPLES		
(i) Vision		
•Elaborate a vision of a future desirable system •Articulate the <u>results</u> you would like to see "What I want" rather than "What I don't want" •Consider environmental and social support systems as well as farm resources •Do not confuse process with results (Process is mapped later in Appropriate Action) •Think in terms of broad, longterm goals rather than setting limits (Later, in the planning section you can site specific objectives and set goals with deadlines) •Do not limit the vision by what appear to be current possibilities •Only once the vision has been articulated compare it to the current situation (i e , acknowledge structural tension)	•The vision should be based on the principles of sustainable systems •Allow the vision to evolve in light of new awareness, understanding and experiences. •The vision will tend to become more "real" as it is "internalized" and also as it begins to manifest itself "externally"	<u>Requirements:</u> •Targeting a future system is dependent on adequate sound information and farmer developing skills and awareness beyond "technical" •The "final" system may look nothing like the original target system. (Even this "final" system will continue to evolve).

Continued

Table 14. (Cont'd)

Early Transitional Stage	Later Transitional Stages (including projections)	Comments: - requirements/projections
	(ii) Efficiency - Substitution - Redesign	
•Study the underlying tenets of a sustainable system and their implications in designing a sustainable system. •Relate your actions (experiments, whole-farm adjustments) to the E-S-R spectrum. Are there gaps, and why might they be there? (i.e., tendency to emphasize efficiency and substitution strategies). •Early transitional stages of increasing efficiency, and substitution strategies involve largely technological barriers •Early redesigns will likely be based on increasing the complexity and diversity of the farm system (e g , crop rotation, integrating crop and livestock components).	•Continue to relate your plans and actions to the E-S-R spectrum Are all three stages (E-S-R) represented in your actions? •Are the necessary redesigns being initiated? Is the farm system becoming more dependent on on-farm cycling? More autonomous and self-reliant? More ecologically complex? •Redesign requires - Heightened awareness and understanding of basic ecological principles, natural cycles and processes - observe your farm and its natural surroundings - search out cycles - imitate and work with nature - where do you and your farm fit within the larger environmental picture? (One cannot relate responsibly to the environment if one remains detached from it) - Getting in touch with oneself. This requires reducing and eliminating psychological barriers and includes value shifts and personal empowerment.	<u>Requirements:</u> •Heightened levels of awareness, broad and longterm vision, personal psychosocial evolution (see Personal Evolution), appropriate skills and information, institutional supports (Hill, 1990b, 1991) •Personal efforts and introspection by the farmer •Adequate and appropriate support from the support group (e g , focus sessions that go beyond "technical support") •Ultimately depends on evolution within society

Continued

Table 14. (Cont'd)

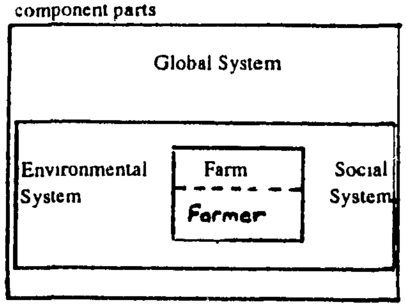
Early Transitional Stage	Later Transitional Stage (includes projections)	Comments: - requirements/projections
	(iii) Holistic Perspective	
●Consider the whole-farm as a system ●Consider all of the linkages, cycles, interdependent processes within the system Think in terms of multiple functions for each component, and necessary functions covered by multiple components (Mollison, 1988) ●Let this awareness influence actions and redesigns	●Seek always to understand the greater whole (Savory, 1988, Fukuoka, 1985), rather than dissecting wholes into component parts 	**Requirements:** ●Holistic outlook should be encouraged within the support group (via workshops, focus sessions, guest speakers). ●Requires personal effort, introspection, evolution ● ". the holistic approach is something that is internalized and largely subconscious. It is achieved, in its "perfect state", by having all sensory and intellectual channels open, i e., without impediments or blockages" (Hill, 1982, p 16)
	(iv) Popular Participation	
●Become an active participant in a support group ●Network - give and receive advice and information - search out like-minded individuals and groups ●Experiment on your own farm ●Farmer - initiated research, demonstration, and information exchange	● Form P-OFR/Associations ● Form cooperative linkages with - rural and advocacy groups - environmental groups - agricultural information and education organizations (i e , merge political, social, institutional, and agricultural agendas) ●Open systems of communication and networking with public and private cooperations ●Form cooperative linkages with other organic/sustainable farmers for marketing opportunities and machinery pools. ●Lobby local university and other research institutions to take on the responsibility of producing locally-relevant research on whole-farm, transitional and sustainable systems ●Lobby government for necessary policy changes and supports	**Requirements:** ●Creation of strong, farmer-directed organizations promoting sustainable agriculture ●Farmer participation in advisory services. ●Regionalization and revitalization within the farming community, e g., importance of municipal organic waste for cash crop farmers ●Enhanced farm linkages with the non-farming community - rural-urban linkages - community supported agricultural projects ●Revaluation of indigenous knowledge systems ●Involvement of the farm family, e g., women and youths.

Table 14. (Cont'd)

Early Transitional Stage	Later Transitional Stages (includes projections)	Comments: - requirements/projections
B - PERSONAL EVOLUTION		
•Think, question, read, observe, reflect, act. •Be the decision maker. Base decisions on correct and total information, and experience. •Keep a personal introspective journal (record hunches, intuitions, insights, ideas, feelings about current values and belief paradigms). - What are your personal/family goals concerning quality of life factors, e.g., self actualization, self-determination, autonomy, work satisfaction •Promote the "human-centred" nature of the support group.	"Make relevant commitments ..." "Take clear, fully human powerful action based on goals" "Recognize the difference between acting on rational thinking and gut feelings vs. superficial feelings (which originate from distress and internalized oppression)" (Hill, 1985, p. 36). •Strive to become self-aware and empowered. •Re-evaluate values regarding nature and society. (Let these influence your visions and your actions). •Support group sessions that focus on quality of life factors (that support self-actualization, self-awareness, and self-determination).	Requirements: •Strive for awareness of everything external (ecology, sociology), internal (psychology), and whole (spirit) (Hill, 1991). •Healing past hurts (Hill, 1978; Jackins, 1965). - Only then can one extend one's ethical framework from self to the support environments. (Hill, 1978).

Note: * The following additional sources have been used in compiling this figure:

Andrews et al. (1990)
Francis et al. (1990)
Fritz (1989)
Hill (1978, 1980a, 1980b, 1991)
Knoblauch (1987)
Lampkin et al. (1986)
Lampkin (1990b)
MacRae et al. (1990b)
Milbrath (1989; 1990)
Patriquin (1990)
Satir (1972)
Savory (1988)

CHAPTER 5: CONCLUSIONS

Six farms in the early stage of transition, from conventional farming to more sustainable farm systems, were followed for a 16 month period. The six participating farmers and two students (myself and a student working on a "partner project" (Nault, 1991)) formed a "support group", based on the Participatory On-Farm Research and Development [7] ideals. This proved to be an effective forum for sharing information, insights, and ideas capable of supporting the farm transition process.

Most of the farmers initiated transition by conducting informal, on-farm experiments of alternative practices, of known agronomic and "environmentally-conserving" merit. The outcomes of the first year included an assemblage of new information about the current farm system, new information about alternative/sustainable principles and practices, and increasing confidence and motivation generated from first-hand experience with these. This, in turn, influenced the scope of farm-level activities planned for the second year. During year two there was a shift to whole-farm, systemic planning, incorporating farm-level readjustments, as well as an expansion in the size and variety of trials.

A model for facilitating the transition process was constructed based on six theoretical constructs of sustainable development (1. vision, 2. creativity, 3. value adjustments, 4. the Efficiency - Substitution - Redesign spectrum, 5. an holistic perspective, and 6. popular participation in the development process), the current popular framework for planning the farm transition, along with insights gathered on the six case farms. This model, effectively a planning template for farmers in transition, and the extension personel working with them, goes beyond the habitual technological focus. It incorporates the tenets of creative vision and problem solving approaches that are necessary in supporting successful transition towards sustainability. It also acknowledges the importance of value adjustments. In the early transitional period most farmers tend to focus on such factors as environmental conservation, reduced pollution of soils and groundwater, and production of a high quality product, free of toxic residues. It is possible, however, that in the future there will be an expansion of both environmental ethics, to include learning from, and working with nature, and heightened social and personal awareness. At the early stage in the transition process the farmers' decision making regarding incorporation of alternative practices and farm-level readjustments appeared to be based on the agronomic merit of the alternatives, rather than on their underlying ecological principles. Also, efficiency and substitution strategies figured more prominently than redesign strategies. The two former are based largely on overcoming the technological barriers hindering farm-level sustainability. In the second year, adoption of more complex, spatially and temporally diverse rotations represented an important and demanding further step in the evolution towards sustainability. Ultimately, however, redesign strategies will require increased awareness (external: ecological and sociological; and internal: psychological), personal empowerment and psychosocial development, and may require value adjustments at the personal and societal levels. At the present time, most of these aspects of redesign are poorly understood. Similarly, the implications of a more holistic perspective of a farm system, both affecting and affected by a social and an environmental support system, requires further development. The "personal", as opposed to the technological and economic, nature of holistic redesign strategies exemplifies the important role the farmer plays in the evolution of the farm system. In the final analysis, the transition process is a product of the qualitative and quantitative characteristics of the driving and restraining forces. These include bio-physical, managerial/skills, informational, socio-political, and personal factors. Actions should be taken to strengthen the driving forces and weaken or remove the restraining forces, at least to the extent that one is aware of them and in a position to do something about them.

The practical model may be further developed and refined as it is extended to the farming community. To date, the success of this project lies in the evolution that has already taken place on the six participating farms, and their ongoing development agendas; the increased enthusiasm and expansion that has taken place within the support group (which now has 12 members and a broadening focus); the increased participation by the farmers within the sustainable agriculture support network; and the expanded awareness of all the co-researchers regarding the development of ecologically sustainable agricultural systems. The validity of the proposed model remains to be tested. Because of its long-term focus, the success and usefulness of the model will be verified by the successful transition of the participating farmers, and other transitional farmers who adopt it.

Footnotes

1. Organic Advisory Service. c/o Elm Farm Research Centre, Hamstead Marshall, Near Newbury, Berkshire, UK. RG150HR.

2. REAP Canada. Box 125, Glenaladale House, Ste. Anne de Bellevue, Que. H9X 1CO.

3. The Practical Farmers of Iowa. c/o Rick Exner, Agronomy Hall, Rm.2104, Iowa State University, Ames, IA 50011.

4. Same as Footnote 2.

5. Same as Footnote 3.

6. The Southwest Wisconsin Farmers' Research Network. c/o Wisconsin Rural Development Center, 1406 Highway 18-151 East, Mount Horeb, WI 53572.

7.Some characteristics of the Participatory On-Farm Research and Development ideal are listed in Fig.3.

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Appendix A

Useful sources used in compiling Fig. 5

Aubert, 1973

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Canadian Organic Growers, 1990

Doram, 1990

"Farmer'transition", 1990

"Field look", 1990

Granatstein, 1988

Hanley, 1980

Janke, 1990

Kirschenmann, 1988

Kirschenmann, 1989

Lampkin, 1985

Lampkin, 1990b

Lampkin et al., 1986

Mac Cormack et al., 1989

MacRae et al., 1990b

Measures, 1990

National Research Council, 1989

Patriquin, 1988

Appendix A (cont'd)

Patriquin, 1989

Patriquin, 1990

Plakolm, 1984

Pousset, 1981

Quinney, 1984

Rodale Institute, undated

Samson, 1989

Samson, 1989/90

Traupman, 1989