EXTENSION AND EDUCATION MATERIALS FOR SUSTAINABLE AGRICULTURE: Volume 1

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EXTENSION AND EDUCATION MATERIALS FOR SUSTAINABLE AGRICULTURE:
Volume 1

A Project of the North Central Region
Sustainable Agriculture Research and Education and
Agriculture in Concert with the Environment

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AN INTRODUCTION

To design the future and to build newness in education, we need to look for emerging principles, not the specifics and details. We think this collection of education materials and ideas for sustainable agriculture shows and contains those emerging principles.

This collection is eclectic - economics, values, leases, production -- for teachers, producers, extension workers. But they must be that way. We must try to discover the generalities of the new educational thrusts that are sustainable agriculture. From this newness, we will see what emerges.

For this project, this eclectic emergence has resulted in this set of materials.

We hope these materials will help set some conditions for people, faculty, administrators, publics, and students to learn from their experiences. These educational encounters will cultivate the shaping and building of new learning environments.

Educators in both formal and informal settings now have the opportunity to mold the conditions to fashion our future. These conditions, the newness, will determine the structure of the future. We believe that these materials can aid in those efforts.

The future is unknown, by definition. We will have to make decisions in contexts that are not well defined. There is no equilibrium; it is a constant state of flux. We have to design educational processes that seek to comprehend as much as possible, knowing it cannot be all, and is able to explain with as much depth and feeling as possible, knowing it cannot be complete.

Building newness will rest upon new visions, requiring new processes.

These materials were assembled and developed by the authors listed with each section. But many people contributed. We want to thank all our producer cooperators:

Jim Bender  Sarah Dean  Ron Ellermeier
Fred Kirschenmann  Tom Larson  Ron Rosmann

Stimulating, fun, challenging, and hard, serious colleagues...thank you! You are true change agents for the future.

To our land-grant colleagues in the extension and teaching side, we want to thank you also for making a major contribution to sustainable agriculture. You stimulated us! Thanks go to:

John Gardner  Don Bullock  Richard Cruse
Kent Crookston  Jerry DeWitt  Jerry Doll
Clive Edwards  John Ikerd  Rich Pirog
Ricardo Salvador  Don Wyse

To our SCS colleague, Linda Oyer, thank you for all your insights and observations.

To our colleague at the National Agricultural Library, Jane Gates, for keeping us in touch with information, thank you.

To our SARE program colleague, Jayne MacLean, we thank you for your sensitivity to key issues in sustainable systems.
To our co-workers, Pam Murray and Michele Strickler with the University of Nebraska Center for Sustainable Agricultural Systems, we owe a great debt of gratitude. Pam was an integral member of the planning group, the thinking group, the doing group, and the keep-us moving group. Michele backstopped everything and everyone. Thanks.

It has been a pleasure to work with you all. Thanks again.

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# Table of Contents

## Volume 1

**Extension and Education Materials for Sustainable Agriculture**

- Future Harvest – Teaching Manual ......................................................... 1
- A Teacher’s Guide to Cropping System Design ............................................. 17
- A Guide to Nitrogen Optimization .............................................................. 33
- Preventative Weed Management .................................................................. 37
- Integrated Soil Fertility Management .......................................................... 47
- The Economics of Sustainable Agriculture ................................................. 59
- A Guide for Lease Structures and Landlord/Tenant Agreements for Converting to More Sustainable Agriculture ................................................................. 71
- The Green Revolution Simulation ............................................................... 103
- The Use of Decision Cases in Agricultural Education & Research .............. 113
- Teaching with Cases ..................................................................................... 119
- Sustainable Systems for the Future: The Nebraska Program .................... 137
- Integration of Environmental & Sustainable Development in Extension: Case Study from Nebraska, USA ................................................................. 149
- Agricultural Producers and Environmentalists: What are Common Goals? .... 179
- Designing the Future Farmscape ................................................................. 189
- Sustainable Agriculture: Designing Future Systems .................................. 191
- Biodiversity in Sustainable Agricultural Systems: How Past Experiences Shape our Vision of the Future ................................................................. 195
- Designing the Future ................................................................................... 199
- A Group Discussion on Sustainability of Agriculture and Rural Communities ................................................................. 203
- A Discussion on Learning and Teaching ...................................................... 209
FUTURE HARVEST --
TEACHING MANUAL

Developed by:
Jim Bender

Audience: Teachers at any level; agricultural professionals

Objectives: To explore in depth the ideas put forth in the book Future Harvest - Pesticide-Free Farming by Jim Bender (University of Nebraska Press, P.O. Box 880520, Lincoln, NE 68588-0520. [$23.50-includes shipping and handling])

This material was prepared with the support of USDA Agreement No. 92-COOP-1-7266. Any opinions, findings, conclusions or recommendations expressed herein are those of the authors and do not necessarily reflect the views of the U.S. Department of Agriculture or the University of Nebraska.
CHAPTER 1 (AND PREFACE): CHANGE: GOALS AND OBJECTIVES

**Chapter Summary** The first section pertains to changes in the structure of agriculture and misconceptions about alternative agriculture which make change from conventional agriculture more difficult. The second section provides a preliminary rationale for adopting the goal of pesticide elimination as opposed to pesticide reduction.

**Teaching Objectives** Students will appreciate the myriad extra-agronomic obstacles to change in agriculture: structural, attitudinal based, political, policy, etc. Another objective is to encourage a more critical approach to the currently popular goal of "reduced" pesticide use.

**Questions**

1. The author mentions in both the preface and Chapter One that a starting point for thinking about agriculture was to suppose that the main objection to alternative agriculture is the belief that it will not work. Why did that supposition prove to be inadequate to the situation?

2. Are you satisfied with the author’s characterization of conventional agriculture?

3. Describe how several of the trends or changes in the structure of agriculture make change from conventional agriculture more difficult. Is one more important than others? Why? Can you think of other problematical trends, such as the infrastructure of irrigation?

4. The author uses the term "dependency" to describe the relationship between conventional farmers and pesticides. What is meant by that? Is it an accurate or useful description? (think of the impact of the trends discussed in the chapter as you formulate your answer)

5. What are some problems with the assertion that alternative farming -- especially organic -- is simply turning back the agricultural clock, that is, reverting to an earlier, more primitive, era in farming?

6. In summarizing obstacles to change the author refers to them as "working together". What could that mean? (think, for example, of a relationship between a paucity of research on organic methods and the perception that organic farming is especially difficult)

7. In outlining the recent politicization of the discussion on this subject, the author uses the terms "fanaticism," and "conceptual squeeze." What do they refer to? What, for that matter, does it mean for discussion to become politicized?
8. Do you share the author’s worry that the term "sustainable" has either lost its usefulness or is often being used mischievously?

9. In beginning to outline reasons for pesticide-free farming the author chose just ground water contamination from many environmental issues. Why?

10. What are two problems with the reduction goal, i.e. the strategy of continuing to use pesticides, but at a reduced quantity?

11. What development in recent pesticide trends allows farmers to convince themselves that they are indeed reducing pesticide usage? What is the problem with this view?

**Special Project**

Invite a no-till or a weed specialist from the ag faculty to make a presentation to the class regarding whether their work in any way entails anything pertaining to reduced pesticide usage. He/she should be expected to be rather specific.

**Further Reading**


CHAPTER 2: CONVERSION

Chapter Summary A method of conversion from conventional to pesticide-free farming is described from the perspectives of agronomics, the federal farm program, non-operating farm owners, lenders and managers, and beginning farmers.

Teaching Objectives Students will learn that key unifying issues are the complexity and importance of extended preparation for conversion to pesticide-free farming.

Questions

1. What is an example of a serious problem likely to be associated with attempting to farm without pesticides all at once?

2. Why does the author place so much importance upon soil conservation in general, and terraces in particular? What special problems could a farmer face who seeks to convert to pesticide-free farming without utilizing terraces and waterways?

3. The author asserts the indispensability of diversified crop rotation and then suggests three crops. What do the listed features of these crops suggest about strategies within crop rotation for meeting objectives of pesticide-free farming?

4. What is the distinction between an experiment without pesticides and the first field without pesticides? Why should the former, but not the latter, take place early in the conversion process?

5. Lime is potentially important at early stages of conversion for two reasons. What are they?

6. What is the relationship between diversified crop rotation and insect control?

7. What is a key problem with the 1985 and 90 farm bills for alternative agriculture? How big a problem is it?

8. Some farming operations have many participants in management. They can include an operator, non-operating owner, farm manager, and lender. Discuss how this situation might complicate conversion to pesticide-free farming.

9. Imagine that you are a non-operating farm owner who has a farm operator who farms conventionally. What proposal could you develop to induce the operator to change?

10. What is a central guiding consideration for beginning farmers as they make decisions about farming practices?

Special Project
With the assistance of your state sustainable ag organization, locate and invite a farmer in the process of conversion to address the group on the problems he/she is facing.

**Further reading**


CHAPTER 3: WEED MANAGEMENT

Chapter Summary  This is a practical and detailed description of weed management which includes treatment of rotation, tillage, planting, post-planting weed control, and discussion of individual weeds.

Teaching objectives  Students will explore the author's conviction that satisfactory weed management is built upon many factors that begin with sophisticated crop rotation, and will develop their own defense of this rationale.

Questions

1. Why should a rotation intended to serve the needs of an organic or pesticide-free system begin with a soil enhancing crop?
2. Why plant late?
3. What is the problem with planting as many acres as fast as possible?
4. Discuss the issues of fast emergence time for the planted crop, the notion of correct soil moisture, and seeding rate as it pertains to weed control.
5. The author mentions the unifying principle of providing a competitive edge for the planted crop. Is that helpful in thinking about strategies for non-chemical weed control?
6. Why should a rotary hoe be as large as possible?
7. What are some considerations in deciding whether to carry out pre- or post-emergence hoeing?
8. What is an advantage and a disadvantage of a harrow for weed management?
9. Why cultivate early?
10. Why does the author regard bindweed a special problem? Why is it that the challenge it presents is not limited to pesticide-free farming?

Special Project

Many agricultural universities now have non-chemical weed control plots. Ask the technician responsible for them at your university to visit with the class. Among other things, ask him/her to discuss one of the weed control ideas in this chapter.
Further Reading


CHAPTER 4: LIVESTOCK

Chapter Summary  The first part seeks to clarify just how important livestock is to alternative systems. Part of that is to respond to the often cited claim that alternative agriculture entails too much livestock. Another subject is a concrete example of how crop and livestock production can be mutually reinforcing. Finally, there is a description of a way of reintroducing livestock to prime farmland which avoids several of the problems commonly associated with doing so.

Teaching Objectives  Students will examine all the issues and reflect on whether livestock is actually as important to alternative agriculture as the author has asserted. Assuming the author is correct, the many implications for agricultural policy will be discussed.

Questions

1. What are some of the ways that livestock are utilized in pesticide-free and organic systems?

2. What is wrong with a common way of thinking about the importance of livestock? How is the author's hypothetical construct of a generalized organic farm without livestock supposed to avoid this problem? How does all this relate to the subject of phosphorus?

3. Livestock are often blamed for soil erosion. The author's view is quite different. What is the basis for such major disagreement?

4. The generalization test -- roughly, posing the question, "What if everybody did it?" -- is mentioned. What value does it have in thinking about agricultural practices?

5. What problems do large scale concentrated livestock production systems present for alternative agriculture?

6. The author attempts to conceive of the minimum number of livestock sufficient to support an organic system? Why would that be useful? Is it possible to carry out such a project?

7. In response to criticism of beef cattle from environmentalism, the author again turns to the subject of livestock in concentration and on farms. How is that intended to respond to those critics? Does it succeed?

8. How do turnips illustrate the idea of organizing systems to make crop and livestock production mutually reinforcing?
9. What are some obstacles to returning livestock to prime farmland? Is the modified dry lot system a satisfactory response? What would be another way of overcoming these obstacles?

**Special Project**

Visit a large commercial feedlot or hog confinement facility. Request the opportunity for the class to ask questions in addition to having a tour.

**Further Reading**


CHAPTER 5: COMPARING SYSTEMS

Chapter Summary This chapter compares organic and conventional systems from the perspectives of convenience, soil conservation, management and cash inputs, an aspect of productivity, and work flow.

Teaching Objectives Students will compose their own lists of comparative advantages of conventional and alternative systems. Students will look in considerable detail at the soil conservation section, and develop their own conclusions about soil conservation and management.

Questions

1. What are some of the inconveniences of chemical weed control in row crops? What are some of the advantages of non-chemical weed control in row crops?

2. Sketch the structure of the argument in the soil conservation section. Are there other structures or practices that could serve as a basis for comparison not included in the discussion?

3. Defenders of conventional systems might reply to the soil conservation challenge by invoking no-till. Would that be a satisfactory response?

4. What does the idea of replacing cash inputs with pure management mean?

5. The five examples include one from each season. Can you think of others? Can you think of an example of the reverse -- where conventional systems replace cash inputs of organic systems with pure management?

6. From the productivity section, interpret the notions of maximizing the maximum versus maximizing the minimum. Are there other ways that the concept of productivity can be misconceived to favor one system or the other?

7. How is the strategy of maximizing the minimum advantageous to society?

8. In the text there is the following statement: "Economic analysis of competing systems, therefore, must develop formulas for factoring the impact of experiment." Explain.

9. Although the work flow is typically very different in the two systems, the organic system has several major disadvantages. Might there be ways to cope with them not mentioned in the text?

Special Project
Take the class to a paradigmatic conventional farm, of more than 500 acres, limited to corn and soybeans in rotation, and without livestock.

**Further Reading**


Strange, Marty, 1988, *Family Farming*, University of Nebraska Press, Lincoln, Institute for Food and Development Policy, San Francisco, chapters 5 and 6.
CHAPTER 6: THE ASSAULT ON ALTERNATIVE AGRICULTURE

Chapter Summary This chapter examines four popular arguments against alternative agriculture: that it will lead to calamity; does not meet the challenge of starving people; that it is motivated by confusion about risk; and a failure to appreciate how safe pesticides can be if used correctly.

Teaching Objectives Students will explore and evaluate the extent to which this discussion has been taken over by public relations efforts by agribusiness, and assess the impact of this trend for public understanding of the issues.

Questions
1. What, specifically, are some of the negative projections for agriculture without pesticides and conventional fertilizers? What is illegitimate about postulating abrupt cessation?
2. The author invokes the recent history of agricultural research, federal farm policy, and tax policy. What do these matters have to do with thinking about a future agriculture without chemicals?
3. At the outset of examination of the Knutson Study there is a list of five central questions to guide discussion. Are these appropriate touchstones? Are there others not listed?
4. Consider the last of the five questions. This tactic is also mentioned in chapter 4. How does it emerge in these two discussion?
5. What is the point of the brief discussion of oats? What is the problem with the Knutson Study projecting an increase in corn acreage in reduced chemical scenarios?
6. What is the preliminary argument in the label directions discussion? What is the relevance of the example of parathion?
7. At the beginning of the long argument the author sets forth his sense of the logic of the subject. Describe and comment.
8. What does chemical synergy have to do with the long argument?
9. If a given pesticide is registered because benefits are deemed to outweigh acknowledged risks, on what basis do you suppose label directions to describe proper use are derived?
10. The three label direction arguments were intended to stand independently of each other. Do they?
11. In the introduction to the label directions section there is the following passage: "For the considerations to follow should have force even if confronted with the most casual sense of safety or acceptable risk." Discuss.

12. Which of the three replies to the feed the hungry argument is most useful? Are there other problems with the argument?

13. Comment on the following quotation from Our Common Future: "...countries that are subsidizing food exports are increasing unemployment in food-importing countries."

14. The "world is filled with risks" argument seeks to "correct" ordinary attitudes about risk. What, from this perspective, is the problem with ordinary attitudes?

15. Industry sponsored analyses of risk assessment tend to stress magnitude. The considerations of risk in the book suggest that there are other important dimensions to risk assessment. Discuss these perspectives.

16. In discussing whether risks and benefits are well understood the author describes a logical problem. What is it?

17. What is the threshold of risk doctrine? Describe one of the problems with it.

Special Projects

To more fully appreciate propagandistic trends in this discussion, have students send for the Food Watch curriculum packet for middle school students. Food Watch is an industry sponsored group which seeks to change attitudes about agriculture. It is called the Abundant Food and Fiber curriculum. The address is:

Agri-Education, Inc.
801 Shakespeare
P.O. Box 497
Stratford, Iowa 50249
(515) 838-2785

Have students videotape several pesticide ads. Study them in class. Examine the purposes of the mood, music, theme, and images. Discuss why they so often include children.

Further Reading


**EPILOGUE AND BENDER FARM PROFILE**

**Summary** The epilogue calls into question a tendency in discussion about alternative agriculture and makes a plea for intellectual honesty on the subject. The profile is simply a description of the Bender farm.

**Teaching Objectives** The epilogue will induce students to reflect upon why this subject includes so much acrimony. Students will want to look at the profile to obtain a sense of accomplishments, problems, and to what extent the farm is a basis for extrapolation to agriculture.

**Questions**

1. The epilogue contains three harsh judgments about alternative agriculture from the academy. How do you react?

2. Consider the question of the outcome of organic cropping practices. It is hard to imagine a more straightforward empirical question, susceptible to scientific study. Why has so much acrimony, defensiveness, and accusation been substituted for getting on with this inquiry?

3. Proponents of alternative agriculture endorse whole system studies. There are many critics of system studies, calling them anecdotal. They sometimes assert that in system studies it is not possible to sort out what is causing what. Is resolving this stalemate necessary to progress in scientific understanding of alternative agriculture?

4. The Bender farm, like every farm, has its own set of circumstances. Critics will assert that in a particular case study there is always something special that curtails applicability. How do you react to that? Do you see anything in the Bender farm that limits extrapolation to other agricultural settings?

5. The profile includes documentation from the 1941 Soil Survey that even by that time many of the slopes of the Bender farm had suffered severe erosion. The point of that inclusion was to demonstrate that the author has accepted the challenge of farming organically on depleted, eroded soils. The idea is that if it can be done in such conditions, then it can be done in less difficult circumstances. Are there any other difficult circumstances about this setting which would make the farm more applicable?

6. Why did the author select the book’s epigraph?

**Special Project**

Take the class to a well managed alternative farm.
Further Reading


A TEACHER'S GUIDE TO CROPPING SYSTEM DESIGN

Developed by:
Thomas Larson

Audience: Teachers or Extension educators

Objectives: To understand cropping system design
To learn methods to teach cropping systems design

This material was prepared with the support of USDA Agreement No. 92-COOP-1-7266. Any opinions, findings, conclusions or recommendations expressed herein are those of the authors and do not necessarily reflect the views of the U.S. Department of Agriculture or the University of Nebraska.
A Teacher's Guide to Cropping System Design

This guide has three major portions:

I. Teacher Reference Guide. Background information for various aspects of system design are listed.

II. Instructional Unit. An outline for the basic course material can be used for planning purposes.

III. Learning Activities. Suggestions for practical application and problem solving activities can be used to enhance the students understanding of the material.
I. Teacher's Reference Guide

1. *Controlling Weeds With Fewer Chemicals* by Craig Cramer
   A collection of cost cutting methods and ideas for weed control in various crop situations.

   Various aspects of legumes are covered in this resource book.

   Soil analysis, deficiency symptoms, tissue sampling and many other topics are covered.

4. *Weeds and What They Tell* by Ehrenfried E. Pfeiffer
   Certain weeds flourish under specific soil and cultural conditions. This book explains some of those relationships.

5. *Planting* - FMO by H. Edward Breece (John Deere)
   Comprehensive descriptions of planting systems and equipment operations,

6. *Farmers of Forty Centuries* by F. H. King
   Chinese agricultural practices of the early 1900's are examined with emphasis placed on utilization of on-site resources.

7. *The One-Straw Revolution* by Masanobu Fukuoka
   This thought provoking book examines extremely low input agricultural systems.

   This directory focuses on resource individuals who do work related to the topic of small-scale agriculture.

9. *The Thompson Farm On-Farm Research* by Rodale Institute
   This book is a summary of the innovative Thompson Farm and some of the alternative farming methods they use.
II. Instructional Unit

Critical Elements of Systems Design

1. Crops to be grown in the system depends upon several factors:

   (a) **Number of crops in the system.**
   This may be only two or up to 5 or 6.

   (b) **Personal Preference.**
   The success of the system may depend upon the familiarity to the farmer of the crops to be grown. For example a corn-soybean system may be more successful than an amaranth-mung bean system.

   (c) **Salable Produce.**
   The Crops grown must be marketable in original form, value added or as a resource to another on-farm enterprise.

   (d) **Site Suitable.**
   The choice of crops to be successfully grown depends on their suitability to the existing climate, soils, slope, and water availability.

   (e) **Government Programs.**
   In the midwest area most crop production is directly linked to the corn base acres. Changes in cropping mix can affect base acres and therefore government program payments. Recently however the ASCS has implemented a program called the Integrated Farm Management Program (IFMP) that lets the farmer keep his corn base acre history while trying to enter a multi-crop system. See the local ASCS for more current information.
**Biodiversity.**
Selecting crops from different families seems to enhance the overall performance of both. A corn-soybean (grass-legume) system seems to perform better than a soybean-pinto bean (legume-legume) system. By selecting crops from different families, populations of damaging disease organisms and pests do not have a chance to build-up. Researchers are still trying to understand various aspects of this "Rotation Effect."

2. **Flow Chart of Normal Cultural Practice.**
A simple calendar type of flow chart for each proposed crop in the system needs to be drawn. Below is an example of such a chart for corn.

<table>
<thead>
<tr>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Ridge</td>
<td>Rotary Cultivate</td>
<td>Till</td>
<td>Hoe</td>
<td>Layby fertilize</td>
<td>irrigation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Harvest</td>
<td>Graze Stalks</td>
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</tr>
</tbody>
</table>

3. **Check for Cultural Practice Conflicts.**
By combining the flow charts for the crops chosen, potential conflicts can be determined. For example, a corn-soybean chart may point out that a time squeeze may occur during cultivation.
4. Post Harvest Use.
A tremendous amount of crop material is left in the field after harvest. Livestock can be used to glean the fields of dropped grain and to consume some of the left over stubble or stalk material. Fields should not be overgrazed to the extent that adequate ground cover is lost. On some soils, livestock should not graze during the late spring season because of compaction problems they might create.
A Teacher's Guide to Hi Tech Low--Impact Farming
by Thomas Larson

The following is an example of a crop-livestock farm that produces corn, dry beans, oats, and turnips in an integrated ridge--till strip crop rotation. Crops are planted in narrow strips (12 1/2 ft) on four 38" rows using the following sequence: Corn, Beans, Oats-Turnips.

There are 6 main features to this crop-livestock system.
1. Narrow crop strips.
2. Built in crop rotation.
3. Opportunity for double cropping.
4. Opportunity for inter-cropping.
5. Work load is spread out.

To properly assess any farming system we must first define conventional farming practices.

Monoculture corn.

In early spring primary tillage is preferred. This may consist of 1-3 trips over the field using a disc-harrow or field cultivator or similar tool that diminished surface residue and aerates the soil. Herbicides and or fertilizers may be incorporated at this time also.

Planting methods vary widely but the trend seems to be toward equipment that will successfully plant in high residue conditions. Factors such as soil type, slope and compatibility with existing equipment determine the planter selection.

During the planting process, insecticides, herbicides and fertilizers may be applied in the same field trip using equipment mounted on the tractor-planter unit.
Weed control may or may not involve the use of a cultivator, depending on the success of the herbicide applied. Modern cultivators are heavy, 250-500 lbs/row, and use designs that allow for effective soil profile aeration (i.e. weed kill by desiccation) or weed burial. Various electronic and/or hydraulic guidance systems are available that help guide this equipment in relation to the plant row. "Cultivator Blight" and operator fatigue are reduced.

Harvesting methods usually employ a self propelled combine using a head or table. Size of the crop gathering head or table is selected to match row width, wheel track, and capacity of the machine.

Grain carts are sometimes employed to expedite removal of grain from the combine while it is in motion. Grain in this cart is then transferred to trucks or trailers on the field perimeter.

The Larson farm tries to employ a cropping sequence that works with nature rather than trying to control it. Conventional crop producers are at the mercy of many things that they have no control over. Weather effects weed pressures, insect damage and ultimately yield. Politics (Government programs, environmental policies, international grain trade, etc.) and world calamities (Chernobyl nuclear disaster, South African drought, etc.) all affect crop prices. Any of the above factors can drive the farmer to control or eliminate as many variables in production he can. This often leads to the adoption of production practices that are preventative, whether they are needed or not. Using broad spectrum pesticides, for example, before any problem or potential problem arises. Use of excessive amount of fertilizer without regard to soil tests and realistic yield goals is another example.

In defense of the above two examples you must be aware that the cost of using the preventative practice is less than the risk of loss in crop yield.
Here is a description of the cropping sequence of one strip over its' three year cycle.

**Year 1**

Corn is ridge till planted one cultivation before 7-8" height. Then layby at knee high, rebuilding the ridge. Harvest, then cows graze the stubble.

**Year 2**

Oats are seeded in early spring by drill or broadcast, then disc lightly. Oats are harvested as grain or oat hay, depending on market conditions.

**Year 3**

Turnips are immediately seeded after oat harvest. By fall grazing period turnips will produce 6 T/acre dry matter at 9-22% and 70-80 %TDN. Turnips will support 300 animal units/acre/day.

Dry beans or soy beans are ridge till planted into oat-turnip strip. After harvest, cows graze on residue.
Year 4

Ridge till plant corn into bean strip. Cycle is complete.

The infield sequence looks like this.

The "rotation effect" of planting different crops on different ground has been well documented for centuries. This system allows for that effect and has advantages and disadvantages as well.
Advantages of this system.

1. Elimination of primary tillage. All crops are either ridge tilled or drilled into the undisturbed seed bed.

2. Reduced need for soil insecticides. Corn is planted on the same ground every third year. This helps disrupt the life cycle of the corn rootworm.

3. Reduced need for soil applied herbicides. Weed pressures respond to the kind of crop grown and the soil type. Planting the same crop once every 3 years helps disrupt this weed cycle.

4. Reduced need for corn borer treatment for some unknown reason. Corn borer larvae infest average only 1-1 1/2 larvae/plant. Economic treatment threshold is 5-6/plant.

5. Reduced peak work-load times. The planting of annual small grains, corn, beans, and turnips naturally are suited for different times. This technique spreads out the planting workload over a much wider "window of opportunity".

6. Harvesting periods are staggered. Oats are harvested in late June, beans in early September, Corn in late September to October, and turnips are strip grazed throughout the fall and early winter.
Disadvantages

1. Participation in government commodity programs may be limited. Check with ASCS about the IFMP.

2. Social aspects. Your neighbors will be curious to say the least. Your banker may refuse to finance you.

3. Timing of the operations are critical. Don't plant more than you feel you can comfortably cultivate. Rescue herbicide-insecticide treatment strategies are becoming more effective and accepted.

4. Oat harvest-haying may interfere with irrigation requirements of corn.

5. Most effective equipment size seems to be 4 or 6 rows. Many operators would be reluctant to downsize even if it would mean an increase in overall efficiency.
Define the following terms.

1. Strip cropping
2. Inter cropping
3. Relay cropping
4. Nutrient cycling
5. Soil microbes
6. Synergism
7. Aelopathy
8. Organic matter
9. Salable Product
10. Integrated Pest Management
III. Learning Objectives

The learner will be able to:

1. List three basic plant families.

2. Describe the cultural practices that apply to the above plants.

3. Draw a flow chart for each of the three plants described above.

4. Identity potential cultural practice conflicts for the chart produced in #3.

5. List four advantages of strip cropping.

6. List four disadvantages of strip cropping.
Methods to Overcome Stumbling Blocks

Reference: The Practice of Creativity by George M. Prince

Pg 15
1. Identify and understand the problem.
2. Collect Relevant information.
3. Mull it over.
4. Speculate.
5. Develop ideas.
6. Select the best idea.
7. Implement it.

Reference Popular Science Jan. '59 pg 128
Also consider looking at the problem.

Backwards, Upside down, Inside out.

Borrow an idea from another area.

Substitute (nails for glue)

Leave something out.

Bigger, Smaller, Stronger, Weaker, Cheaper
A GUIDE TO NITROGEN OPTIMIZATION

Developed by:
Ronald L. Rosmann

Audience: Extension personnel and College teachers

Objectives: To discuss nitrogen optimization
To develop strategies to encourage soil testing by producers

This material was prepared with the support of USDA Agreement No. 92-COOP-1-7266. Any opinions, findings, conclusions or recommendations expressed herein are those of the authors and do not necessarily reflect the views of the U.S. Department of Agriculture of the University of Nebraska.
A GUIDE TO NITROGEN OPTIMIZATION

During 1992, in Iowa alone, 1.5 billion lbs. of nitrogen fertilizer was applied. This however represents a reduction for the third year in a row.

1985 - 144 lbs.
1990 - 127 lbs.
1991 - 120 lbs.
1992 - 118 lbs.

Nationally, however, nitrogen use has actually risen slightly. Corn growers applied N to 97% of the 71.4 million acres of corn in the 17 states surveyed in 1992, according to the USDA. The average rate was 129 lbs./acre which was up one pound from 1991.

The reduction in N usage in Iowa is attributed to better soil testing and the use of the Late Spring Soil Nitrate Test developed by Dr. Alfred Blackmer, professor of agronomy, Iowa State University. Farmers are also learning better application techniques, have better equipment and are beginning to give credits for other sources of nitrogen as a result of educational programs.

On-farm evaluations during the past several years by ISU and the PRACTICAL FARMERS OF IOWA organization showed that the use of the soil test enabled producers to reduce inputs of N fertilizer by one-third with no significant reductions in yields. This means more profits for the producer, less environmental concerns, less dependence on fossil fuels to manufacture N, and more dollars in rural communities, according to the revised bulletin on "Nitrogen Management" published by ISU Extension in March, 1993. The number of dollars that Iowa farmers could save through the use of the test is staggering - up to 100 million dollars per year!

In addition to the revised bulletin, there needs to be more of a teaching device in a total package that could help farmers, Extension, students, fertilizer dealers, and consultants to identify options and procedures for fine-tuning of nitrogen optimization. The teaching device, either in the written or video form, would revolve around the late spring soil nitrate test.

First, farmers need to be convinced they should use the test. Secondly, they should have a way to compare different nitrogen rates using the test on some of their fields. This could be accomplished through the use of the PRACTICAL FARMERS OF IOWA on-farm research trial format. We, and other PFI farmers have been doing that for the last six years, where the farmers customary rate of nitrogen applications have been compared to a lower rate of nitrogen based, (most of the time), on the use of the test. Results from 1987-1991 have indicated in 63 N trials a reduction from 133 to 79 lbs. of N without any yield reduction. (129.1 high rate yield, 127.8 low rate yield) The low rate benefit was $6.56/acre and the diesel fuel equivalent saved in gallons per acre was
12.9. On our farm, we have saved close to $2,000 annually through the use of the test.

Dr. Blackmer has stated that "if you use soil tests, you can get by with less than if you don't. The amount you use is based on your knowledge."

To me this says that the farmer needs to begin to use the test to get some experience and confidence in it and to gain confidence in working within a fairly narrow range of nitrogen rates on site-specific locations. We have been working at this since 1987. I can now say with some confidence that because of the trials we have done, we no longer need to rely as much on the late spring test as before. We have identified, based on crop rotations, manure history, weather conditions, the late spring test, legume credits, and the fall stalk test, a fairly narrow range of needed additional N rates. This has ranged from 0-90 pounds since 1987. Most of the time, it has been from 0-60 lbs. of additional N needed, according to the test.

How do you get people to start using the test so that eventually they may no longer need to depend on it? The N-Trac test kit from Hack Chemical Company has not really caught on. Farmers do not appear very willing to take samples and send them into a lab, either. The test is not seen as being very user friendly. Here is a list of impediments:

1) Have to take the test when the corn is 6--12 inches tall
2) Farmers want to have their nitrogen on by then
3) Large numbers of acres
4) Weather concerns about getting additional N applied
5) Do not want to cultivate (sidedress with cultivator)
6) Afraid of using the test

FOR DISCUSSION:

1. How can we encourage farmers to start using soil test?
2. How can we overcome the six objections?
PREVENTATIVE WEED MANAGEMENT

Developed by:
Jerry Doll

Audience: Extension, SCS, and ASCS professional; agricultural producers; agriculture students

Objectives: To understand the role of preventative weed management in an overall farming strategy

This material was prepared with the support of USDA Agreement No. 92-COOP-1-7266. Any opinions, findings, conclusions or recommendations expressed herein are those of the authors and do not necessarily reflect the views of the U.S. Department of Agriculture or the University of Nebraska.
Preventative Weed Management

Jerry Doll
Weed Scientist, Dept. of Agronomy
Univ. of Wisconsin, Madison

An ounce of prevention is still worth a pound of cure. Examples abound of how we have introduced plant species either inadvertently or as potential crops that are now our common and serious weed control problems. Johnson grass and velvetleaf were introduced as crops while most species "hitch hiked" as contaminants of crop seeds. An awareness of how weeds spread into new areas and what we can do to prevent such movement equips us to be avoid having more weeds to worry about.

Prevention should be part of a comprehensive weed management program (Fig. 1). Prevention is stopping a weed from infesting new areas. Common practices to do this include:

- Buy and plant clean seed
- Buy clean feed and bedding
- Clean machinery when leaving weedy fields
- Do not introduce new species into fields by spreading weed seed-infested manure
- Check custom equipment entering your fields
- Prevent seed production in fence rows, field borders and roadsides
- Keep informed of new weeds in your area and state

The consequences of not practicing these preventative measures can have long lasting consequences because once a weed is present on a farm, eradication (the complete elimination of all live plants, plant parts and seeds from an area) is nearly impossible. Once introduced, we are left with decisions about how to control/manage (limiting or reducing the weed infestation to tolerable levels (thresholds) the weeds present.

An often unconsidered source of introducing weeds is in feed. In Wisconsin, many dairy farmers have fed small quantities of cotton seed as a protein and energy source. The delinting process to separate the cotton fiber and seeds leaves cocklebur fruits with the cotton seed. Many farmers have potentially infested their farms with this highly competitive broadleaf weed in recent years. Another practice gaining popularity
among dairy farmers is to feed roasted soybeans to milking cows. When properly done, the roasting process destroys all weed seeds.

In years of hay shortage, many livestock producers purchase hay; sometimes it comes from other states. Regardless of the distance, the risk of bringing in viable weed seed is great and perhaps some will be new species to that farm. The hay curing process does not kill many weed seeds; nor does digestion in the rumen nor storage in manure. An effective means to destroy weed seeds in livestock feed is to ensile the forage. The fermentation process destroys nearly all common annual grass and broadleaf seeds. Even most of the hard seeds of velvetleaf are killed.

Straw used for bedding is frequently infested with weed seeds and these, too, will cycle through the animals and back onto the fields. Composting manure will reduce but not eliminate viable weed seeds. Poultry are more effective in destroying weed seed than ruminant and monogastric animals.

A recent concern that adds more importance to a vigilant prevention program is the appearance of herbicide resistant weeds in the U.S. Feed or crop seed contaminated with weed seed may well not bring a new species to a farm, but rather a new gene - one that may greatly reduce the performance of current weed management programs. It is impossible to visually separate resistant plants or seeds from their susceptible biotypes. The difference is at the gene level and is not evident in any external characteristics.

One means of preventing weed introduction and spread is via the legal route. For example, governments may decide to quarantine infested areas to prevent further movement of a serious weed problem. One of the most aggressive cases of weed quarantine in the USA is a federally funded program to contain and simultaneously eradicate the parasitic weed witchweed (*Striga asiatica*) that infests grass crops such as corn and sorghum and causes untold losses in other countries. It was introduced into North and South Carolina in the 1950s and it was placed under federal and state quarantine in 1957. Now, some 35 years later, the original infestation of 430,000 acres was reduced to 387,000 acres in 1980 and is now down to 48,000 acres with just scattered infestations.

Only in 1975 did the United States enact a Federal Noxious Weed Act. It was funded in 1979 and has designated certain species as those that should not be allowed to enter the U.S. A 746-page handbook of "Economically Important Foreign Weeds" was prepared and contains over 1200 species that federal inspectors can use to determine if imported goods, travelers, livestock, etc. should be quarantined or rejected as the port of entry. While no one believes that this is a fool-proof system, it has been helpful. For example, serrated tussock (*Nassella trichotoma*) was detected on a shipment of turfgrass seed originating in Argentina and was rejected at the port in Texas.

Many states have noxious weed laws. These laws are designed to both help prevent the spread of serious weeds and to require that some control effort be done by the land owner/operator. The state of Nebraska has one of the most active programs.
They have a state-wide Weed Control Association, hire and train weed superintendents in each county, publish a newsletter, do state-wide weed surveys, etc. While most states have not been as active as Nebraska, the noxious weed laws do point out what are the weeds of concern and most producers then realize that extra efforts to contain and control these species is both warranted and probably a legal requirement. Additionally, state seed certification laws and perhaps feed laws also regulate the species for which weed seeds are either prohibited or restricted.

Another aspect of prevention is to not allow weeds in fields to reproduce. By preventing seed production, the number of seeds in the soil will certainly be reduced and perhaps we can approach eradication of species with relatively short seed longevity in the soil. This approach has worked well, for example, to greatly reduce the abundance of wild proso millet (*Panicum miliaceum*) in Wisconsin. If infested fields are planted to alfalfa, almost no millet goes to seed as long as alfalfa is present. So when other crops are planted for 4 or more years later, most of the millet seed has died. Some use this concept to say that any weed going to seed is a problem. This is perhaps theoretically true, but in the real world, a few seeds are not going to quickly change the weed management practices. First, all fields have some level of a weed seed bank and a few thousand seeds per acre produced annually will not cause great alterations. Secondly, estimates are that 90% of all weed seed produced dies, is eaten, rots, germinates without emergence, or is otherwise lost and does not form a seedling. And lastly, growers who closely monitor their fields can decide when control practices simply for the sake of preventing weed seed production are justified. Action would be needed when (1) it is very difficult to control species and (2) when weeds are found only in certain areas of fields (such as along field edges).
QUESTIONS RELATED TO PREVENTATIVE WEED MANAGEMENT STRATEGIES AND PRACTICES

1. My fields are already weedy. Why should I be preventative?

2. Rank the risk of introducing weeds coming onto farms (5 = high risk; 3 = moderate risk; 1 = low risk; 0 = no risk).
   __ contaminated certified seed
   __ contaminated feed grains
   __ contaminated hay
   __ contaminated straw for bedding
   __ purchased fertilizer
   __ contaminated bin-run seed
   __ custom combining
   __ water
   __ birds and other animals
   __ wind
   __ manure from the neighbors

3. Assume your red clover is contaminated with 0.5% lambsquarters seed. You are seeding 12 lb/acre of red clover and one pound of lambsquarters has 300,000 seeds. How many seeds or lambsquarters are you planting?

4. You are feeding roasted soybeans to your dairy cows. You bought a load of roasted beans at the feed supply company and note there are many weed seeds in it. You should:
   __ reject the load
   __ accept the load because seeds will die in the cow’s rumen
   __ accept the load because roasting kills all weed seeds
5. What are the common sense practices to prevent weed introduction onto your farm?

6. I am harvesting forage in a field with many flowering weeds. To prevent spreading these weeds to other fields I should:

   ___ chop/cut the forage and leave it in the field
   ___ bale the forage: most seeds will die in the rumen and manure
   ___ ensile the forage: most seeds will die in the fermentation process in the silo
   ___ bale it and sell it to the highest bidder
BUT IT'S ONLY A LITTLE BIT CONTAMINATED !!!

RED CLOVER SEEDED AT 12 LB/ACRE CONTAMINATED WITH 0.1% WEED SEED WOULD PLANT:

4,300 WHITE COCKLE SEED
6,000 DODDER SEEDS
13,200 PIGWEED SEEDS
3,900 CURLED DOCK SEEDS
WEEDS FOUND IN WISCONSIN SOYBEAN SEED SURVEY

- PLANTERS WERE CHECKED BY CROP IMPROVEMENT ASSOCIATION INSPECTORS

- DONE IN 1984 ON 102 PLANTERS IN 14 COUNTIES

<table>
<thead>
<tr>
<th>FACTOR</th>
<th>CERTIFIED SEED</th>
<th>UNCERTIFIED SEED</th>
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<tr>
<td></td>
<td>(% NOT MEETING STANDARDS)</td>
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<tr>
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<td>29</td>
<td>87</td>
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<tr>
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<td>18</td>
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<td>0</td>
<td>18</td>
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<tr>
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<tr>
<td>Wrong Variety</td>
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<td>Weed Seed</td>
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44
WHERE'D ALL THOSE WEEDS COME FROM ??????

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<tr>
<th>WEED</th>
<th>ORIGIN</th>
<th>CAME TO U.S. AS:</th>
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<tr>
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<td>SYRIA</td>
<td>FORAGE CROP</td>
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<td>COGON GRASS</td>
<td>ASIA</td>
<td>PACKING MATERIAL FOR ORANGE TREES FROM JAPAN</td>
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<tr>
<td>MULTIFLORA ROSE</td>
<td>JAPAN</td>
<td>WILDLIFE, CONSERVATION</td>
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<td>JIMSON WEED</td>
<td>TROPICS</td>
<td>ORNAMENTAL</td>
</tr>
<tr>
<td>MUSK THISTLE</td>
<td>EUROPE</td>
<td>ORNAMENTAL</td>
</tr>
<tr>
<td>YELLOW TOAD FLAX</td>
<td>EUROPE</td>
<td>ORNAMENTAL</td>
</tr>
<tr>
<td>PURPLE LOOSE STRIFE</td>
<td>?</td>
<td>ORNAMENTAL</td>
</tr>
<tr>
<td>VELVETLEAF</td>
<td>CHINA</td>
<td>FIBER</td>
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INTERGRATED SOIL FERTILITY MANAGEMENT

Developed by:
Linda J. Oyer

Audience: Extension personnel and upper level higher education

Objectives: To identify soil fertility problematics as related to production system
To develop creative methodologies for working with producers and achieving technology exchange to solve soil fertility problems

This material was prepared with the support of USDA Agreement No. 92-COOP-1-7266. Any opinions, findings, conclusions or recommendations expressed herein are those of the authors and do not necessarily reflect the views of the U.S. Department of Agriculture or the University of Nebraska.
WHAT IS SUSTAINABLE AGRICULTURE?

SUSTAINABLE AGRICULTURE is the production of food and fiber of suitable quality in optimum quantities in a manner which is resource efficient, resource conserving, environmentally sound, economically feasible, and socially responsible.

- USDA/SCS, 1990

ROLE OF INTEGRATED RESOURCE MANAGEMENT SYSTEMS IN SUSTAINABLE AGRICULTURE

The USDA Soil Conservation Service has defined its role in promoting sustainable agriculture as assisting producers to plan and apply integrated resource management systems. These systems achieve environmental quality and economic viability by collectively maintaining or improving soil, water, air, plant, and animal resources. Sustainable agriculture requires the highest level of application of integrated resource management systems, giving adequate consideration to the changing environmental, social, economic, and cultural needs, conditions, available resources, and opportunities at the field, local, and more global levels, with the active participation of the producer throughout the entire process.
WHAT IS INTEGRATED FERTILITY MANAGEMENT?

INTEGRATED FERTILITY MANAGEMENT involves:

* the proper management of nutrients to improve or maintain the fertility of the soil while not adversely affecting another resource condition

* utilizing appropriate sources, rates, methods, and timing of application of nutrients

* utilizing appropriate cropping and residue management systems

* proper consideration of ecological, social, economic, and cultural factors influencing the production system

* the balanced, systematic integration of technologies, management strategies, and methods which have been selected to meet the environmental, economic, and social criteria of sustainability.

* being integral part of integrated resource management system
WHY TECHNOLOGY EXCHANGE VS TRANSFER?

* Technology "transfer" should preferably be an exchange.

* The "experts" or those that provide a service for the producer must learn to listen to producers.

* Producers know the problems as well as know their goals, resources, and potentials, and may have already developed an innovative practice or method for confronting the problem.

* Cooperatively, agricultural agents and producers can utilize the most appropriate technology and utilize available resources to develop a solution to the site-specific problem.

* Active involvement of the producer during all stages of the planning, application, and evaluation process of the integrated resource management system will promote not only a more effective information dissemination, but also a more effective communication process, a most essential step toward resolving agricultural problems and developing a sustainable agriculture.
PRINCIPLES TO INTEGRATE INTO PROCESS OF PLANNING AND APPLYING INTEGRATED RESOURCE MANAGEMENT SYSTEMS

* think system - planners must think in terms of natural resources as an ecosystem. They must place the agricultural ecosystem into its economic and sociologic context as well. Planners look carefully at each resource condition and consider how it relates to the management unit as a whole. They must also consider how management options will complement each other and interact with existing systems on adjoining management units. As planners of systems of resources, they must think as ecologists, sociologists, and economists all-in-one of the system in order to effectively identify and solve agricultural problems.

* actively involve the producer at all times throughout the process - Development of effective management systems requires participation by and consideration of people throughout the planning process. Effective planners recognize that the producer has knowledge, skills, and abilities that are complementary to those of the planner.

* think resource opportunity - effective application of integrated resource management systems requires that the planner look beyond resource problems. While examining the whole operation, planners will be alert to potential resource uses that may exist on the land or locally.
PRINCIPLES TO INTEGRATE INTO PROCESS OF PLANNING AND APPLYING INTEGRATED RESOURCE MANAGEMENT SYSTEMS

* **think resource efficiency** - effective planning for sustainable agriculture seeks to use locally available resources as production inputs and reduce use of external or remote resources. This promotes reduced input costs and improved efficiency of resource use.

* **think off-site effects** - planners and producers must consider both on-site and off-site effects of integrated resource management systems in order to reduce adverse effects to the environment.

* **plan creatively and flexibly** - planners must present feasible, creative alternative solutions and design systems which are flexible enough to adapt to meet changing ecological as well as socioeconomic needs.

- Safley and Oyer, 1990
IDENTIFICATION OF FERTILITY PROBLEMATICs

1. Discuss producer’s objectives and perspective on problem and resource opportunities, as well as make field assessment, including:

   * soil resource - type, texture, depth, organic matter content, erosion (water and wind), pH, color, compaction, sediment deposition, water infiltration, - any observations of problems in past or at present

   * topography of landscape - % slope, average length of slope, land capability classification

   * presence of water bodies, seeps, runoff, inadequate outlets, ground water or surface water contaminants, e.g. pesticides, nutrients, salinity, heavy metals, pathogens

   * perspective on water quality status or problems - source, quality for drinking or irrigation

   * precipitation, temperature regimes - observations of damage to crops due to air drift, drought, hail, wind, flooding

   * past, actual and desired cropping systems

   * other crops or cropping systems tried locally and level of success

   * historical crop yields and goals

   * utilization of crops

   * residue management - all operations carried out and estimate of residue remaining after planting
IDENTIFICATION OF FERTILITY PROBLEMATICs

1. Discuss producer’s objectives and perspective on problem and resource opportunities, as well as make field assessment, including:
   (continued)

* nutrient additions - source, rate, time, and method of application
* potential sources of nutrients available on-farm or locally
* control of pests - historical incidence of pests and methods of control
* desire to provide habitat for wildlife - type, availability of food, cover or shelter, water
* production of livestock and relationship with crop fields - grazing, production, storage and utilization of manure
* resource conservation practices already installed and status
* other concerns, including: land tenure, market structure, cost share, base acreage, USDA programs, technical assistance, traditional values; availability of labor, machinery, seeds, agrochemical inputs; prices of agricultural inputs;
IDENTIFICATION OF FERTILITY PROBLEMATICS

2. Take soil sample for soil fertility

* take individual soil samples according to instructions given by land grant university
* record the crop history, manure applications and prior legume crops from each soil mapping unit
* air dry and ship to an ASCS approved laboratory

3. Know community problematics well and discuss with other organizations.

* relate facts obtained at field level to watershed to community level and to global level
* interact daily with producers via homestays, coffee shop discussions, help organize local research/demonstration plots and informal field days, help organize exchange seminars
* discuss problematics with other producers and representatives of other organizations; provide feedback on status of perspectives; promote exchange of experiences; help organize support for providing alternative solutions.
EVALUATION OF ALTERNATIVES WITH PRODUCER AND SELECTION OF INTEGRATED FERTILITY MANAGEMENT SYSTEM

* Once the fertility results of the soil analysis are received and the problematics have been analyzed, the cropping system can be chosen and designed and the appropriate integrated fertility management program can be selected to best suit the changing needs of the system.

* Based upon the selected cropping system, including intercrop, legume, monocrop, the crop nutrient budget should be prepared. All sources of nutrients should be considered, including legume, fertilizer, irrigation, manure, in determining an appropriate rate, timing and method of application. The appropriate residue management system should also be selected to meet the criteria of sustainability.

* When formulating and recommending alternative conservation practices for the integrated resource management system to be applied in the field, it is very important to consider the potential impacts of each practice on each resource problem and to ensure that there will be no adverse effects either on-site or off-site to another resource. The alternative conservation practices proposed as part of the integrated resource management system should collectively seek to solve all of the resource problems identified.
PREPARING THE CROP NUTRIENT BUDGET

* Prepare a nutrient budget for each field when the soil test results are received back from the lab.

* Develop a realistic yield goal based on land grant university data, soil management groups, county plot data, and producer records.

* Balance the nutrient needs for each crop and credit manure applications as well as legumes grown in rotation. (example of development of nutrient budget included with this packet)

* The largest agricultural N cycle inputs are usually fertilizer N, manure N, legume N, and irrigation water N; fertilizer N and irrigation water N are most accurately known since these are managed inputs; the manure input as well as the legume N input are known only roughly. Even less research has focused on determining the appropriate nutrient recommendations for crops grown in row-intercropped systems versus for crops in comparable single stands.
ROLE OF ON-FARM INTEGRATED RESEARCH/Demonstrations IN INTEGRATED FERTILITY MANAGEMENT

* Integrating agricultural research and education with full participation of producers is the principal key to determining and solving our agricultural problems.

* Countless projects have been designed and implemented by researchers with little or without producer participation and which failed; those projects did not define the problem well nor did they consider the interrelation between socioeconomic and environmental factors, and, therefore, the project design was not appropriate to actually confront the problem. In reality, many times the project design actually reinforced the problem and worsened the situation.

* The integrated focus of on-farm research/demonstrations will respond to the problem of the inefficiency of much research conducted on experimental stations due to the lack of producer involvement, the lack of a systems approach, and the lack of representativity of many of the soils, slopes, and microclimates present on those stations.
THE ECONOMICS OF SUSTAINABLE AGRICULTURE

Developed by:
Frederick Kirschenmann

Audience: Producers, Extension, SCS, and ASCS professionals

Objectives: To discuss alternative ways of thinking about agricultural economics

To identify key components for short and long term economic sustainability on the farm
THE ECONOMICS OF SUSTAINABLE AGRICULTURE

TEACHING GOAL: To engage farmers and extension personnel in a dialogue on issues surrounding agricultural economics from a perspective of sustainability.

LEARNING OBJECTIVES:

* To explore alternative ways of thinking about agricultural economics that are more inclusive and that focus on real on-farm impacts.

* To identify key components for thinking about both short and long term economic sustainability on the farm.

ANTICIPATED BEHAVIORAL OUTCOMES:

* Farmers will begin to look at the economic parameters of their own farms from a more integrated, whole-systems perspective, and extension personnel will be able to more effectively assist farmers in this task.
THE ECONOMICS OF SUSTAINABLE AGRICULTURE

I. FRAMING THE BIG PICTURE

Economists have tended to gauge the economic health of a farm by determining the monetary performance of individual on-farm enterprises in a fiscal year. What's missing from this picture?

1. The On-Farm Economic Picture.

a. Determining the Performance of the Farming Sector.

For the past 80 years there has been a trend toward increasing economic activity in the market and input sectors of agriculture and decreasing economic activity in the farming sector. Some economists claim that this trend is due largely to public policy and research priorities rather than on-farm efficiencies. How sustainable will agriculture be if this trend continues?


b. Determining the Viability of Increased Production Efficiencies.

Some economists argue that since the farming sector's piece of the economic pie is so small further efficiencies in production can benefit neither the farmer nor the consumer. John Ikerd points out, for example, that an additional 10 percent increase in production efficiency (which he regards a significant technological achievement) could, at best, achieve a one percent reduction in food costs to consumers.

And since the farmer's share of total consumer expenditures is now so small (less than 1.5%) Ikerd argues that a 10% increase in production efficiency on the part of production agriculture would "get lost in aggregate economic statistics".

Can further production efficiencies make agriculture more sustainable? How does the "technological treadmill" effect the sustainability of agriculture on the farm?

Suggested Reading: John Ikerd, "Impacts of Policy on the
Economics of Sustainable Agriculture” (Unpublished paper, December 2, 1992; Available from the Author, University of Missouri-Columbia).

c. Determining Real On-farm Efficiency

Economic sustainability depends on sound, efficient performance over the long term.

For the most part farmers have been taught to assess the economic performance of their farms by calculating yield per acre and pound of gain per day. This has led them to ignore important factors on the cost side of the ledger. Such as the long term costs of pest resistance and destruction of beneficial insects; the cost/benefit of the additional fertilizer required to produce that extra 5 bushels of yield; or the increased cost of health maintenance due to stress related illness caused by management practices used to achieve gain goals. How can farmers begin calculating the overall economic performance of their farms over a decade or more, rather than limiting themselves to single enterprise performance analyses over a single growing season?


2.1 The Macroeconomic Picture.

Economic sustainability is also determined by the fiscal and monetary policies at the national and international levels. How can farmers join with other citizens to better understand how current policies effect both their short term and long term economic sustainability, and to effect policy changes?

Suggested Readings:

2.2 The Social Picture.

Society’s mandate for agriculture has changed. For most of this century the social mandate for agriculture was simply to produce the maximum amount of food at the cheapest possible price. Today the mandate is to produce the maximum amount of the safest, most nutritious food in the world at the cheapest possible price, in an environmentally benign manner, that will preserve the resource base for future generations, treat animals humanely, and treat farmers and farm-workers fairly.
Can the goal of a sustainable agriculture be achieved in the light of this new mandate? Can agricultural sustainability be achieved in the face of mounting political pressure from various citizen lobby groups -- animal welfare, animal rights, food safety activists, wildlife preservation, environmental regulation, etc. etc.?


3. The Ecological Picture.

It is now generally conceded that the ecological capital being expended to achieve the goals of industrial agriculture is not sustainable. We have lost approximately half of our topsoil in the last forty years. Aquifers are being drained at a rate far exceeding nature's capacity to recharge them and both ground and surface water is being contaminated. The loss of wildlife has been significant. Predator/prey relationships have been disturbed. Insects beneficial to farmers are destroyed along with target insects, increasing the problems of pest control. And the evolution of weed and insect species resistant to pesticides have further complicated pest control management.

What are the economic "costs" to agriculture of these ecological consequences of industrial agriculture? Can agriculture be sustainable if these trends continue?


4. The Energy Picture.

All agriculture is dependent on energy. Industrial agriculture is especially dependent on nonrenewable sources of energy, not only consuming such energy for traction, but for fertilizer and pest-control, extensive transportation, etc.

How can agriculture be sustained in the face of high energy requirements and dwindling non-renewable resources? How can farmers become more energy efficient and self-sufficient?
THE KEY BIG-PICTURE QUESTION IS:

HOW CAN FARMERS BEGIN TO POSITION THEMSELVES TO BECOME MORE ECONOMICALLY SUSTAINABLE IN THE LIGHT OF THESE ECONOMIC, SOCIAL, ECOLOGICAL AND ENERGY ISSUES, IN WAYS THAT ARE ECOLOGICALLY SOUND, SOCIALLY ACCEPTABLE AND LESS ENERGY INTENSIVE?

In the light of Steward Smith's analysis farmers might consider exploring two immediate strategies:

a. Reduce their dependence on the input sector of agriculture.

b. Explore ways to recapture part of the market sector of agriculture.

What are some of the ways that farmers can accomplish these changes?

II. SOME CLUES TO ECONOMIC SUSTAINABILITY FOR THE FARM

INTRODUCTION:

Broadly speaking, economics can be defined in two ways: It can either be understood in terms of

* the short term maximization of the monetary exchange value to the owner

or

* the long term increase in value to the community.

The former is what we usually point to as an indication of "growth", the latter is what is generally required to achieve "development".

In modern economics we often assume that "growth" (in the former sense) will automatically bring "development" (in the latter sense). Is this true? Is it true if we include land, water, and other organisms of the early community (on which we depend for agriculture) in our definition of "community"? What is required to maintain the financial health of agriculture?

Suggested readings: Herman E. Daly and John B. Cobb, For the Common Good, (Boston: Beacon Press, 1989). Especially chapter 7; Paul Ekins, (ed), The
**SOME KEY INDICATORS TO CONSIDER:**

1. Assessing the financial health of the whole farm over a decade vs
   Analyzing the profit/loss of individual enterprises over a single growing season.

   Most farmers know, from experience, that isolated enterprises on their farms can be extremely profitable for one or more growing seasons and still not add up to a prosperous farming operation. While the profit/loss statements of single enterprises on the farm serve as one important clue to the farm's profitability, other important factors must be calculated in determining a farm's financial health. For example, a high value crop may prove to be very profitable for two or three years, but a single hail storm could put that farm into bankruptcy due to the high cost of producing the crop.


2. Diversification vs. Specialization

   Modern agriculture has increasingly moved toward specialization to achieve economic objectives. It was assumed that specializing in the highest paying cash crop and becoming an expert in the production management of that one crop, had the best potential for the highest economic return to the farm. But there are many inefficiencies in specialization.

   Specialization has created dependency on off-farm inputs. Continuous mono-cropping causes fertility deficiencies that must be replaced by fertilizer inputs. It also creates favorable environments for pests that require pesticides to control weeds and insects. Diversification, on the other hand, can create opportunities to use on-farm resources. Crop rotations can include crops that supply much of a farm's fertility needs and can develop growing environments that interrupt weed and insect cycles.

   Diversification creates opportunities to use the wastes from one enterprise as inputs for another enterprise. Crop residues can have value added to them by feeding them to livestock. The wastes from livestock can be used as fertility inputs in the cropping enterprise, thereby turning the cost of waste disposal into an income producing input.
Diversification also spreads out risks. Different crops are susceptible to different weather factors. A variety of crops reduce the susceptibility to specific pests. A variety of enterprises reduce the vulnerability to market fluctuations. Specialization also creates other long-term problems that add costs to the farm such as breakdown in soil structure, resistance to pests, etc.

Of course diversification by itself will not insure profitability. Diversification must be integrated into an efficient whole system. Each piece of the diversity must fit into and feed the performance of the whole system. How can farmers better assess the right amount of diversity, integrated into a whole, efficient operation, to maximize the economic performance of their farms?


The economics of modern, industrial agriculture is based on a "factory" input/output model. The cost of inputs purchased from off the farm, required to achieve outcome goals, are charged against revenues anticipated from the sale of outputs. In this model capital expenditures (including land) tend to be seen as depreciable items. In this model soil and water, the critical wealth-generating resource base, are seldom considered as part of the economic model.

This model also makes farmers extraordinarily dependent on the input sector of agriculture, leading them to ignore on-farm resources that could often be utilized to achieve production goals and utilize wastes.

Since the 1920's numerous agriculture leaders have suggested an economic pattern for agriculture based on a recycling model. This model attempts to achieve outcome goals by utilizing on-farm resources as the first management strategy. Off-farm inputs are used as back-up resources. This strategy seeks to utilize all waste materials by recycling them into the production system.

What are some of the economic implications of this shift in thinking? What are some of the potential impacts on soil and water conservation? Can such a shift in thinking begin to rebalance the farming sector economy
vis-a-vis the input sector?


4. Farm Value-retained Economics.

Stuart Smith has pointed out that one of the reasons that the farm sector of the economy has shrunk is because farmers have spun some of their market activities off the farm into the market sector. Conversely, one of the ways that farmers can improve the farm sector economy is to recapture part of this economic activity.

What are some of the practical ways that farmers can retain value in the farm sector? How can the potential for retaining value be increased through local community cooperation and farmer-owned cooperatives?


5. Redefining Economic Efficiency.

Efficiency has generally been taken to mean producing more with less capital. In other words efficiency is defined in money terms. A farm is "successful" if it produces a surplus of capital to invest -- in expansion, for example. This view of efficiency is consistent with the neoclassical economic dogma that there are no shortages where there is sufficient capital.

This view of economics ignores a fundamental component of the second law of thermodynamics -- that "whenever energy is used the amount of usable energy declines". (Daly & Cobb, 1989) This fundamental law of nature suggests that whenever soil, water and oil are used to produce food something is lost. True efficiency has to keep these losses to a minimum. In other words, true efficiency includes not only non-wasteful use of labor and capital, but also conservation of natural resources.

These divergent views of efficiency explain why industrial agriculture can be heralded as the "most efficient in the world" and simultaneously be characterized as the least efficient. Industrial agriculture is extremely efficient when measured only in terms of labor and capital expended. It becomes enormously inefficient when measured in terms of the use of nature resources. Both have to be included in the equation.

How can farmers begin to calculate true efficiency on their farms? Does the present structure of agriculture force farmers to choose between labor/capital efficiency and natural resources efficiency?

No one would question the fact that modern industrial agriculture has been enormously successful in fulfilling its mandate -- producing the maximum amount of food and fiber at the cheapest possible price. What has been ignored in the process is what economists have referred to as "externalities" -- the social and environmental costs of doing business. But whether these costs are deferred to the future or charged to environmental and social accounts, they are real costs.

The government-industrial complex (USDA, traditional farm groups, commodity groups, etc.) have been slow to recognize these costs. But gradually they are being recognized. Citizen/environmental groups, scholars, and farmers themselves have amassed impressive evidence that these "hidden" costs are now appearing and can no longer be ignored. Consequently a new social mandate for agriculture is upon us.

What are some of the social and ecological costs of farming that farmers must include in their costs of doing business? How can some of these costs be reduced? What public policy changes are needed to account for these costs in the food system?


7. Reassessing the Role of Rural Communities.

Conventional wisdom has largely disregarded the economic role which rural communities play in the economics of agriculture. Rural communities are generally viewed as anachronisms, having outlived their economic, and therefore their social value. This prevailing view is now being challenged. Farmers are recognizing that the disappearance of rural communities is increasing their cost of production. Having to drive two
or three times the distance to buy equipment parts costs additional travel and down time and requires farmers to stock more of their own parts. Having to send children to school in distant communities increases the tax burden. etc. etc.

Furthermore, local communities are the repositories of local ecological wisdom. The loss of this local "library" of information cannot even be calculated at this point, but it is a loss that will be difficult to retrieve.

How can farmers and policy makers reassess the role of rural communities in sustaining a healthy, secure food system? What can farmers and local rural community residents do to sustain their livelihoods? Can a more sustainable agriculture help?


8. Other Bottom Lines.

Despite the fact that farmers have been forced to concentrate most of their energies on maintaining a healthy bottom line, they, and their colleagues in rural communities, are increasingly becoming aware that there is more to life than bread. Simply maintaining an income level that keeps the wolf away from the door does not constitute a life.

Increasingly, therefore, questions about quality of life, and social goals are being considered as part of the sustainable agriculture agenda. Slowly we are beginning to recognize that a set of values that we call "the common good" underlies everything that all of us do. Farming is no exception.

How can farmers begin including social goals in their economic planning? Is a "bottom up society, a community of communiques that are local and relatively small" (Cobb & Daley) a desirable goal for agriculture? If so, how do we achieve it?

A GUIDE FOR LEASE STRUCTURES AND LANDLORD/TENANT AGREEMENTS FOR CONVERTING TO MORE SUSTAINABLE AGRICULTURE

Developed by:
Sarah Simpson Dean
for Simpson Ranch

Audience: Landowners, farmers, farm managers, crop consultants, university faculty and classes, and extension personnel

Objectives: To show processes which encourage conversion to a more sustainable agriculture

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1. INTRODUCTION - PHILOSOPHY:

The PURPOSE of a FARM LEASE is to list the rights and duties of the landowner and the farmer-tenant in regard to the farm.

It is a LEGALLY BINDING CONTRACT.

The lease creates the "PARTNERSHIP" between the landowner and the farmer-tenant. It outlines how they will work together to MANAGE the farm so that the GOALS OF EACH ARE MET.

The lease cannot cover everything. Therefore, the landowner and the farmer-tenant must trust each other and feel any problems can be resolved by them.

DISCUSSION QUESTIONS:

Is a lease same as partnership?
Characteristics of each?

How would you describe relationship between owner and tenant ideally?

How detailed or how general should a lease be?
THUMB RULES FOR LEASING:

Never sign a lease unless you trust the signer/person/entity's ability to execute the agreement.

"Work with someone you enjoy and respect."

Keep it simple.

Address issues of concern or special and unique importance to signatories with specificity yet breadth to "get at the heart" of the issues.

Try to prevent surprises.

Create a document of reasonable, clearly stated expectations.

Understand what you sign.

Be specific on financial arrangements. Keep philosophies and "artistic", or farm specific management more general.

DISCUSSION QUESTIONS:
2. **SAMPLES (from Simpson Farms)**

   Simpson Ranch Goals and Objectives for Sustainable Ag Farming

   Simpson Ranch - Farm Information

   Simpson Farms Sustainable Ag Lease

   Financing Equipment Letter of Agreement

   Expectations List

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**DISCUSSION OF SAMPLES:**

**DISCUSSION QUESTIONS:**
3. OTHER REFERENCES


Journal of Soil and Water Conservation, Jim Bender "Converting to pesticide-free farming: Coping with institutions" (Jan/Feb 1990)

Land Link, Center for Rural Affairs, Post Office Box 406, Walthill, NE 68067-0406.

"Adjusting Farm Tenancy Practices to Support Sustainable Ag", by Prof. Neil D. Hamilton. Nat'l Center for Ag Law Research and Info. @ Univ. of Arkansas College of Law. 1990

DISCUSSION QUESTIONS:
4. **LEASE COMPONENTS - COMPONENT DEVELOPMENT BY PARTICIPANTS**

Facilitator and participant identification and discussion on components from samples.

Component examples:

- Term of lease
- Goals
- Gov't Program
- Owner's Payment
- Owner's Expenses
- Special Crops, i.e. hay/alfalfa
- Grazing
- Legal aspects (liability, termination, crop insurance, access, oil & gas, eminent domain, heirs/successors, assignment, liability insurance, etc.)
- Financial capacity to perform
- Farm Plan (soil conservation, livestock, herbicides, fertility, rotation, cover crop, experiments/demos, tillage, etc.)
5. WORKSHEET  BUILD A LEASE

Have participants build (choose components) their own lease.
1989-90

SIMPSON RANCH GOALS:

1. Long-term preservation and enhancement of productive soils.
2. Reasonable sustained profits.
3. Minimize adverse impact on environment.

CONTINUING OBJECTIVES:

1. Do not use excess N and/or P & K.
2. Maintain or increase % organic matter and obtain as much N as possible from legumes, cover crops, residue, manure, - to decrease cost of chemical fertilizer, and to improve soil tilth.
3. Increase cover crops, inter-cropping, strip cropping to decrease soil erosion.
4. Emphasize rotations to minimize need for herbicides and insecticides.
5. Introduce banding, timely tillage and other sustainable weed control practices which reduce chemical usage.
6. Look at strip cropping and/or inter-cropping as a way to accomplish many of the above objectives, using conventional equipment and practices.
7. Consider ridge till in the future to accomplish goals.

THE CHALLENGE:

"Simpson Ranch, has for some time, wanted to initiate programs on its farms that move in the direction of lowering inputs while still maintaining its level of income. Simpson Ranch is concerned about protecting ground water and surface water from pesticides and fertilizers and at the same time aggressively reducing soil erosion. We are committed to this change and feel that it is one that will protect the environment, sustain the soil for generations, and at the same time maintain or increase your income and that of Simpson Ranch."

Letter to Simpson Ranch operators from John M. Simpson, Oct. 1988
<table>
<thead>
<tr>
<th>County</th>
<th>Farmers Livestock</th>
<th>Manure for S/R</th>
<th>Application of Fert &amp; Other Chem</th>
<th>Gov't Payment</th>
<th>On Farm “Research”</th>
<th>Other</th>
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<td>BROWN COUNTY</td>
<td></td>
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<tr>
<td>Robinson Scott Voigts</td>
<td>Dairy Farm</td>
<td>Yes</td>
<td>Farmer</td>
<td>Co-op</td>
<td>Ridge till 10-14% slopes</td>
<td>1/3 farm in alfalfa</td>
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<tr>
<td>Gordon Bruning</td>
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<td></td>
<td></td>
<td></td>
<td>Strip Cropping</td>
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<td>E Hiawatha</td>
<td>No</td>
<td>No</td>
<td>Farmer</td>
<td>Farmer</td>
<td>Three strips O/CL - C - SB</td>
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<tr>
<td>W Hiawatha</td>
<td>No</td>
<td>No</td>
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<tr>
<td>Terry &amp; Robert</td>
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<td>N/A</td>
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<td>Reschke</td>
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<td>How farm end of 10 years?</td>
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<td>ATCHISON COUNTY</td>
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<tr>
<td>N of Effingham</td>
<td>Small beef herd</td>
<td>No</td>
<td>Both</td>
<td>Farmer</td>
<td>Interested in cover crops following wheat</td>
<td></td>
</tr>
<tr>
<td>Rick Taliaferro</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Alfalfa</td>
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<td></td>
<td></td>
<td>Keep &quot;cover&quot; on year round</td>
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<td>LEAVENWORTH COUNTY</td>
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<td>Leavenworth Farm</td>
<td>Hogs and beef herd</td>
<td>No</td>
<td>Co-op</td>
<td>Co-op</td>
<td>1-Clover in wheat-plow down 2-80 ac strip crop 1992</td>
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<td>Sam &amp; Craig Lohman</td>
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<td></td>
<td></td>
<td></td>
<td>for HEL compliance instead of terrace or no till</td>
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<td>Jarbalo Sam &amp; Craig</td>
<td>No</td>
<td>No</td>
<td>Co-op</td>
<td>Co-op</td>
<td>Bottomland on Stranger Creek floods 1 of 5 yrs</td>
<td></td>
</tr>
<tr>
<td>Lohman</td>
<td></td>
<td></td>
<td></td>
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<td>SALINE COUNTY</td>
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<tr>
<td>Assaria/Salina SDB</td>
<td>No</td>
<td>No</td>
<td>Both</td>
<td>Co-op</td>
<td>Wanted to try clover in wheat 2 yrs but dryness did</td>
<td></td>
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<tr>
<td>Emery Frost</td>
<td></td>
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<td>not allow it</td>
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</table>

Sample
Simpson Ranch
4330 Shawnee Mission Parkway
Suite 132
Fairway, Kansas 66205
(913) 236-7333
FARM LEASE

This lease is made this ______ day of ______________, 19____, between (Lessor/Owner’s Name) , (hereafter referred to as "O" Owner , and (Lessee/Farmer’s Name) (hereinafter referred to as "F" Farmer ).

O_______ hereby leases to F________, and F________ hereby leases from O_______, the following described real estate in ________ County _______ (State): 

Jarbalo Farm

Legal description:
That portion of the Northwest 1/4 of Section 3, Township 10, Range 21, (approximately 105 acres) owned by O_______.

That real estate is hereafter referred to as the "farm", and it is leased to F_______ upon the following terms and conditions:

1. The term of this lease begins on ______________, and ends ______________.

2. O_______ desires to have the farm operated so that its goals for the farm are attained. The following are the goals of O_______ and F_______ shall conduct farming operations so that there is progress towards those goals:

   (a) Maintenance of positive sustained annual net income which results in a reasonable return on O_______’s investment.

   (b) Management and operation of the farm in ways which lead to long-term preservation and enhancement of productive soils.

   (c) Implementation of farming practices which minimize adverse impacts on the immediate and off-farm environment.

3. F_______ shall faithfully and promptly in a good farmer-like manner and at the proper times, plan, prepare, and plant the cultivated lands. During the growing season, F_______ agrees to
cultivate or take other appropriate steps to keep the growing crops reasonably free of weeds, insects, pests, and other damaging growths. When the crops are ripe and mature, F______ agrees to harvest them in a prompt and expeditious manner, and to deliver his/her and O_____'s share of them to the customary markets.

4. F______ shall plant crops on cultivated land in compliance with any government programs which are applicable to the leased land, and if at any time during the term hereof any of the leased land is entered into any government program, it shall be upon terms and conditions mutually agreed upon by the parties.

5. Except for alfalfa or other hay crops, F______ agrees to account for and deliver to O______ rent as follows:

(a) One-half of all grain delivered to the local market, free of expense to O______ except as specified in paragraph 6 below.

(b) One-half of all government crop program payments.

(c) F______ shall not sell or market O______'s share of the crops without written consent of O______ or O______'s authorized agent. In the event F______ is authorized to sell O______'s share of the crops, payment shall be made in the name of O______.

6. Except for alfalfa or other hay crops, O______ agrees to pay the expenses as follows:

(a) One-half of all seed, fertilizer, herbicides and insecticides.

(b) The entire cost of lime, but any lime application must have written approval.

(c) Seventeen Dollars ($17.00) per acre for combining O______'s one-half of the crop.

(d) Eleven cents ($.11) per bushel for O______'s one-half share of grain delivered to elevator within 15 miles. If it is a greater distance, hauling will be agreed upon at a normal hauling rate.

(e) One-half of the soil testing fee which is $3.00 per cultivated acre. Terms of payment for the soil testing services shall be those specified by Crop Quest of Dodge City, Kansas. F______ shall conduct soil testing in accordance with the program developed by Crop Quest for the farm. F______ shall not exceed rates of application of fertilizers recommended by Crop Quest without prior approval of O______.

7. If F______ shall raise an alfalfa crop on the farm, O______
and F____ shall share income and expense for that crop as follows:

(a) F____ shall be entitled to 75% of the crop, and O____ shall be entitled to 25% of the crop. O____'s share of the crop shall be harvested and stored by F____ in the same manner as the share of F____.

(b) F____ shall pay all the costs of planting, production, harvesting, hauling, and sales.

(c) F____ shall report the results of each cutting to O____ within two weeks of the completion of cutting, swathing, baling, or stacking. The report shall include, but not be limited to, date of cutting and baling or stacking, condition of the cutting, estimated quantity in tons (pounds) per unit and total tons in the cutting, estimated by the following method: F____ shall select 50 small square bales or 5 large bales or stacks at random from across the field, and the weight of those bales or stacks shall be determined. The average weight of each of those bales or stacks shall be multiplied by the total number of bales or stacks in the cutting to determine the weight of the hay produced in a cutting.

(d) O____ shall be paid for O____'s share of each cutting within 45 days of completion of each cutting. The price to be paid for O____'s share shall be the amount that it is sold for before the end of that 45 day period. If any of the crop is sold, it shall be considered that 25% of the part sold belongs to O____. If all or part of O____'s share is not sold at the end of that 45 day period, O____ shall be paid at that time for O____'s share that is not sold. The purchase price for that unsold share shall be the price quoted in the High Plains Journal first published after each cutting is available for use. The price shall reflect (1) the price applicable to Southeast Kansas and (2) the dairy premium price for dairy hay unless F____'s post-cutting report specifies that adverse weather prevented F____ from putting up premium quality hay, and if that is the case, the preferred price for feedlot quality hay shall be used.

8. F____ shall not graze livestock on any of the cultivated land, or permit others to do so without permission of O____ in writing.

9. F____ shall not sublet or assign this lease without the written consent of O____.

10. F____ agrees at all times to save O____ harmless from all loss, liability, costs, or damages that may occur or be claimed with respect to any person or persons, corporation, property or chattels on or about the farm or to the property itself resulting from any act done or omission by or through
F, his agents, employees, invitees or any person on the land by reason of F's use or occupancy or resulting from F's non-use or possession of said property and any and all loss, cost, liability or expense resulting therefrom. At all times F shall maintain the farm in a safe and careful manner.

11. O or O's authorized agent may enter the farm at reasonable hours to examine the same and to do anything O may be required to do hereunder or which O may deem necessary for the good of the farm or any improvements.

12. Under no circumstances shall F retain possession of the farm or any part thereof beyond the expiration of this lease without written permission of O. Any plowing or any other work performed by F on the farm prior to the termination of this lease shall give F no right to hold over, and he/she shall quit and surrender the property and farm in as good state and condition as when accepted, reasonable wear and tear excepted, upon the expiration hereof. If F has crops, other than alfalfa or hay, growing on the farm at the time of the termination of the lease and if F planted those other crops before he/she received notice of termination of the lease, then F shall have the right to harvest those crops and receive his/her share of said crops so harvested. F shall have no right to an alfalfa or hay crop after the lease terminates.

13. If the farm or any part thereof shall be taken by any competent authority under the power of eminent domain or be acquired for any public or quasi-public use or purpose, this lease shall terminate as to the part taken. Any and all awards, damages or allowances awarded or allowed with respect to any condemnation or eminent domain proceeding shall be the property of O, and F shall have no claim or part in any award; except it is provided, that if the condemning authority allows, in addition to the value of the property taken, a separate and additional award for crop damages, F shall be allowed his share of the value of the growing crops and any preparation done toward the planting or growing of crops on the farm so condemned. F shall have the right to remove any personal property located on the part acquired by eminent domain if the acquiring body so permits and subject to other terms of this lease.

14. This lease is made expressly subject to any oil and gas lease or leases now existing, if any, and O has the right to execute and deliver future oil and gas leases, division orders, pipe line and unitization agreements and to grant easements and rights of way or any other interest in and to the farm necessary for the furtherance of production of oil, gas and other minerals from the farm, to all of which this lease shall be subject.

15. If default be made by F of any of the terms and condi-
tions of this lease or in the accounting to O______, O______ shall have the right to enter and take possession of the farm or any part thereof, whereupon this lease shall terminate and F______ shall peaceably deliver possession without process of law, and such termination shall not entitle F______ to any rebate of the rental paid at the time of such termination, and F______ shall be liable for any loss or damage suffered by O______ for F______'s failure to comply with the terms hereof.

16. The provisions and conditions of this lease shall bind and inure to the benefit of the legal representatives, heirs, successors and assigns of each of the parties hereto, except that no assignment or subletting by F______ without the written consent of O______ shall vest any right in the assignee or sublessee of F______.

17. In addition to the foregoing agreements, it is further agreed:

   (a) O______ and F______, at their own expense, shall provide for such insurance on crops, improvements on the farm, and the contents thereof, as each of them may deem necessary or advisable to protect their own interest.

   (b) F______ covenants and agrees to maintain at all times, (at F______'s expense) during the term of this lease, comprehensive public liability insurance in a responsible insurance company, licensed to do business in (State) and satisfactory to O______, properly protecting and indemnifying O______ in an amount of not less than three hundred thousand dollars ($300,000.00) for injury to or death of any persons arising out of any one occurrence, and not less than one hundred thousand dollars ($100,000.00) for property damage. F______ shall furnish O______ with a certificate or certificates of insurance, covering such insurance so maintained by F______, on or before _____________.

   (c) F______ SHALL SUBMIT A WRITTEN FARM PLAN for O______'s approval prior to the beginning of spring field work. The plan shall contain a description of practices F______ intends to implement during the term of this lease, consistent with the goals specified in paragraph 2. F______'s plan shall contain but not be limited to the following:

       (1) At least one experiment or research project which F______ intends to implement on one or more selected plots. The experiment or research should be tailored to demonstrate the effects of a change in farming practices consistent with O______'s goals specified in paragraph 2 and which follow standard farm extension research procedures. The size of the plot should be inversely proportional to the level of risk or uncertainty inherent in the experiment. (Examples: Replace broadcast herbicide spray with banded spray, ridge-till, intercrops and covercrops,
high-value or novelty crops, organic farming.)

(2) A listing of any changes in farming practices to be applied to the whole farm or to whole fields. (Examples: elimination of fall tillage, elimination of one or more pre-plant tillage operations, replacement of disking with undercutting, split application of fertilizer, integration of livestock, wildlife habitat enhancement.)

(3) A description of continuing education measures \( F \) intends to carry out to keep abreast of new knowledge in the area of sustainable/alternative/low-input/ or organic farming. This should include but not be limited to: meetings, symposia, seminars, workshops, field days; periodicals \( F \) now receives and or plans to acquire; (Examples: "Dick & Sharon Thompson Field Days", Kansas Rural Center Farm Tours or Conferences, Ridge Till Conference, Experiment Station Farm Tours on legumes, cover cropping, reducing chemicals, etc., Kansas Rural Center publications, "The New Farm" magazine, "American Journal of Alternative Agriculture", Minnesota Land Stewardship Newsletter and publications.)

Optional

18. \( F \) also agrees to place and maintain on the farm at all times a minimum of six No-Hunting signs. These signs shall be placed in positions clearly visible to the public. \( O \) and its guests may hunt on the farm at any time or place. \( F \) shall not give permission to any person to hunt on the farm.

9. \( F \) will provide to \( O \) at \( O \)'s office, on or before (date 2 months prior to beginning of lease), documentation (financial statement, or letter from lender) satisfactory to \( O \), of \( F \)'s financial ability to carry out the terms of a similar lease that might be entered into for the succeeding crop year.

The parties have signed this lease on the date first above written.

(Owner’s name typed):

By: (signature) Date:
Partner, Trustee, Owner

(Farmer’s name typed):

By: (signature) Date:
LETTER OF AGREEMENT, SIMPSON RANCH & SCOTT VOIGTS
RIDGE TILL EQUIPMENT & RIDGE TILL FARMING on Voigts Farm

SIMPSON RANCH (S.R.) shall pay Scott Voigts (full purchase price) for purchase of ridge till cultivator, to be used in development and implementation of a ridge till system of farming on entire tillable acres (440 ac.) of Voigts Farm during the period 1993 to December 31, 1997.

In return SIMPSON RANCH requires that Scott Voigts make a good farmer reasonable effort, as detailed in the attached document, "Expectations - 1993", to keep the Voigts Farm in HEL compliance according to Brown Co. SCS, while implementing the described ridge till system.

Equipment under consideration for purchase in order of purchasing sequence is as follows:

- Buffalo Cultivator 1993 or 1994
- Planter-one of the options below, 1994 or 1995
  - Modifications or additional eqpt. on Voigts planter.
  - John Deere planter with modifications or other suitable substitute planter equipment.
  - Buffalo planter.

Method of Payment to Voigts by S.R.:
S.R. is willing to pay Voigts (2/3 of purchase price) upon purchase of cultivator equipment plus 4 equal payments per year - (1/3 of purchase price divided by four equal payments) each payment. The payments shall be made on January 1st of 1994, 1995, 1996 and 1997.

SIMPSON RANCH claim on equipment:
S.R. will not own the cultivator upon purchase.
Voigts may not sell or mortgage the cultivator prior to December 31, 1997, or unless this agreement is terminated as below, or by other mutual agreement between Voigts and S.R.
Conditions where S.R. may claim or sell the cultivator are as follows:
During the period from March 1993 until December 31, 1997, if Scott Voigts is unable due to illness, disability or death, or
fails through lack of effort to fulfill the intent of implementing a ridge till system as described in the attached document, "Expectations February 1993", or his lease with S.R. is not renewed by him or S.R., S.R. may claim the cultivator. If S.R. claims the cultivator, then Voigts may pay S.R. an amount equal to payments already paid to Voigts less 10% per year and Voigts owns the cultivator. If S.R. claims the cultivator, and if Voigts does not elect to pay S.R. for it, S.R. has the right to sell the cultivator and keep the proceeds of the sale.

S.R. shall not have any claim on the cultivator or rights to reimbursement after December 31, 1997.

__________________________________________  __________________________
Scott Voigts                                    John M. Simpson
Date________________________                     Date________________________

__________________________________________
Sarah S. Dean
Date________________________

Partners SIMPSON RANCH
"EXPECTATIONS 1993"
Concerns and topics which must be addressed before entering into an equipment/ridge till system agreement with Scott:

I.
Identify WATERWAYS and TILE OUTLETS with Matt Sprick, Brown County SCS, which need installation as soon as possible, in order to apply for cost share in 1993.

SCOTT ASSUME RESPONSIBILITY OF SCHEDULING in 1993 & '94, AND COMPLETING by end of 1994. Scott coordinate with SCS and contractor. Sarah, (owner), must be kept informed as to cost. Expecting maximum $7000 if no cost share. With cost share, maybe $4 or $5,000. Scott monitor cost, cost share applications, and construction.

What are cost share deadlines for 1993 and 1994?
Likely areas needing attention:
Field # 4 w of house, currently in alfalfa.
There are 3 or four areas. Are any on the east side eligible for cost share?
Field # 2 N. across cement.
Are we sure what we want? Or want to delay until are more certain? Especially since we will not get any cost share.
Field # 8 S of house.
Same as field #2. Are we sure what we want?
No cost share since considered repair.
Field # 7 Large field, drains to E into "creek". Steep.
Four areas? New, so eligible for cost share?
SCHEDULE THESE FIRST? to apply for cost share '93 and again '94?
Field #6 N ridge till field. "L" extension with outlets.
SCHEDULED SPRING 1993 with cost share.

II.
What I would like to see in 5 years - Year-end 1997:

Crops:
All cropland in ridge till.
Alfalfa on 1/4 to 1/3 of farm. Trying strips of alf in some fields.
Other crops in rotation: wheat, SB, Milo or 90 day corn.
Ultimate goal is like Gary Leosing, Nebraska University Extension, proposed with alf in for 3 or 4 years strips, then rotating by fields, wheat, SB, M in the strips of alfalfa.

Herbicides:
Reduced by at least 75% from 1992.
Working towards complete elimination.
Fertility:
Usage of manure as much as possible. More control on testing and application. Work with Crop Quest.
How will manure be incorporated into ridge till system?

Cover and Intercropping:
This will not be fully developed by 5 years, but we should be experimenting with legumes, within that time.
Develop vetch, clover, or oats to help with supplying nitrogen and to keep areas covered in winter, especially following beans. Use to suppress weeds and incorporate for soil building.

III.
COMPLIANCE - Scott's Responsibility
1993 & 1994 We will be in compliance. Construct outlets & ww.

1995 It would be nice to be in compliance with clever usage of alfalfa and ridge till on most of the cropland. Maybe some oats or vetch over winter '94/'95 for cover to maintain compliance. I am willing to accept non-compliance for this year if need be.

1996 and into the future. We should be in compliance with combinations of ridge till, alfalfa in fields or strips where needed, cropping W/SB/M or C, beginning intercropping and cover cropping.

IV.
MAPPING

The maps identify cropping sequences and plans for introducing ridge till, by fields, by year. The maps identify alfalfa in fields or strips and introduction of intercropping/cover cropping.

This is our plan of intent.
LAND LINK REALTY
101 South Tallman
P.O. Box 405
Walthill, Ne 68067

LAND LINK REALTY
SAMPLE LEASE
LEASE SUPPLEMENT
AND
LEASE CLAUSES

Land Link Realty is a service of the Center for Rural Affairs
SAMPLE LEASE FORM
LAND STEWARDSHIP LEASING AGREEMENT

This agreement, made and executed this ___ day of _____ , 19__, by and between ________________________, of the county of ________________, State of Nebraska, hereinafter called "Landlord and ________________________, of the county of ________________, State of Nebraska, hereinafter called "Tenant": WITNESSETH, That the Landlord, in consideration for the rents and covenants herein specified, does hereby let and lease to the Tenant the following described property, situated in the county of ________________, State of Nebraska, to wit:

together with the appurtenances thereto belonging, for the term of _____ years, commencing the ___ day of ______, 19__, and ending on the ___ day of ______, 19___. Said Tenant does hereby hire said premises, and agrees with the Landlord, as payment to said Landlord for the use, benefit, and occupancy of the above described premises, that s/he will and does hereby bind himself/herself as follows:

First: To cultivate all the tillable land on said premises in a sustainable manner as follows:
1) Weed and Pest Control
   a) (see sample clauses)
2) Tillage Practices
   a) (see sample clauses)
3) Management of Soil Nutrients
   a) (see sample clauses)
4) Soil Conservation Practices
   a) (see sample clauses)
5) General Stewardship Practices

Second. That s/he will allow no waste during his/her occupancy of said premises, of fencing thereon, of timber, nor damage to any building thereon, natural wear and tear or damage by the elements excepted.

Third. Said Tenant does hereby further agree that s/he will, at his/her own expense, during the continuance of the lease, keep said premises and every part thereof in good repair; that s/he will not sublease, release, or assign this lease, without the written consent of said Landlord; and that s/he will, at the expiration of said term of rental, yield and deliver up the property therein rented in like condition as was taken, together with all improvements that may be placed thereon by said Landlord during his/her occupancy thereof, reasonable use and wear thereof and damages by the elements excepted.

Fourth. For the use of said premises for the term mentioned, s/he hereby covenants and promises to pay to said Landlord a _______ percent share of crops grown, properly take care of, at the same time and in the same manner in which said Tenant shall take care of his/her portion of said crops; and when harvested, said landlord's share of said grain shall be delivered at a place and time designated by the Landlord.
Fifth. The Landlord does covenant that said Tenant, on delivering the aforesaid share of grain in the manner herein stated, and performing all the covenants aforesaid, shall and may peaceably and quietly have, hold and enjoy the said premises for the term aforesaid: provided, that in case any rent shall be due and unpaid, or if default shall be made in any of the covenants herein contained, or said Tenant shall allow undue waste or destruction of any of the grain growing thereon, then it shall be lawful for said Landlord, to reenter and repossess the said premises at once and the Tenant and each and every occupant remove and put out.

Sixth. The Landlord, or its lawful successor in interest, hereby reserves the right to reenter the aforesaid premises after the ____ day of _______, 19____. Witness our hands the day and year first above written.
SAMPLE LEASE SUPPLEMENT

SUSTAINABLE AGRICULTURAL PRACTICES

The parties hereto agree to all of the following provisions and attach them to the lease dated and signed on the _____ day of ____________, 19__.

The land covered by this lease will be used in approximately the following manner. Appropriate adjustments of this use can be made by mutual agreement between the parties.

<table>
<thead>
<tr>
<th>CROP LAND</th>
<th>OTHER LAND</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Row crops ____ acres</td>
<td>A. Permanent Pasture ____ acres</td>
</tr>
<tr>
<td>B. Small grain ____ acres</td>
<td>B. Rotated Pasture ____ acres</td>
</tr>
<tr>
<td>C. Legumes ____ acres</td>
<td>C. ____ acres</td>
</tr>
<tr>
<td>D. Other Crop ____ acres</td>
<td>D. ____ acres</td>
</tr>
</tbody>
</table>

The following agricultural practices will be adhered to when operating the land.
1. WEED AND PEST CONTROL
   (see sample clauses)

2. TILLAGE PRACTICES
   (see sample clauses)

3. MANAGEMENT OF SOIL NUTRIENTS
   (see sample clauses)

4. SOIL CONSERVATION PRACTICES
   (see sample clauses)

5. GENERAL STEWARDSHIP CONCERNS
   (see sample clauses)

Dated this ____ day of __________, 19____
SAMPLE LEASE CLAUSES:

The following items are examples of the type of clauses that a landlord may want included in a lease. These items are intended to be inserted within the body of the sample lease shown. However, any item could be drawn separately as a lease supplement and attached to an existing lease.

1. Weed and pest control
   a. The tenant agrees to scout for insect populations and apply chemical controls only after such scouting indicates that pests are at the level sufficient to cause economic loss.
   b. The tenant agrees to control noxious weeds using nonchemical means if possible, in a timely fashion prior to action by government officials.
   c. The tenant agrees to use mechanical and nonchemical means of control as the primary methods of controlling weeds on crop ground.
   d. When possible, the tenant will delay mowing of road ditches, field edges, grass waterways, set aside acres and other areas of vegetation until after the nesting period for game and songbirds has passed.
e. When methods of chemical control of weeds are employed the tenant agrees to use application implements to band the chemicals and agrees to apply them at rates not exceeding the minimums recommended by the manufacturer or extension officials.

f. The tenant shall insure that for all fields on which corn was produced, livestock are grazed on the stalk ground prior to the time for spring field preparation. If the tenant does not own livestock, any rent received from leasing the stalk ground shall be divided % between the tenant and the landlord.

g. The tenant agrees not to use aerial spraying without the permission of the landlord.

2. Tillage Practices
a. The tenant agrees not to use a moldboard plow.

b. The tenant agrees not to use a moldboard plow for fall tillage on ground to be planted the following spring.

c. The tenant agrees that if any field work is to be done in the fall at least two-thirds of the soil will be left covered with crop residue.

d. The tenant agrees not to till any permanent pasture, meadow, native prairie, or forage crops without the permission of the landlord.
e. The tenant agrees to use **reduced tillage methods** for the production of row crops where feasible.

f. The tenant agrees to farm pursuant to a conservation plan developed in cooperation with the landlord and state and federal soil conservation officials.

g. Tenant agrees to develop a conservation plan with the Soil Conservation District which brings the soil loss down to the "T" (tolerable) level set by the USDA Soil Conservation District.

**Management of Soil Nutrients**

a. The tenant agrees to spread all available animal manure on fields, but only when the ground is not frozen. Whenever possible, liquid manures from livestock confinement-operations and feedlots will be incorporated into the ground the same day as it is spread.

b. The tenant will, in cooperation with the local extension authorities, develop a system for growing green manure crops which can be planted in the fall and incorporated into the soil prior to spring planting.
c. The landlord shall in the division of costs and expenses under the lease, give the tenant credit for the nutrient value of green manure crops as demonstrated by subsequent soil fertility test or in direct proportion to the cost of producing the crop.

d. The tenant will apply purchased fertilizers only after having taken soil samples and having received two analyses of the soil test. Fertilizers shall be applied at a rate no greater than the least recommended rate.

e. The tenant will not apply nitrogen fertilizers in the fall for crops to be planted the following spring. Prior to the application of nitrogen in the spring the tenant shall employ nitrogen soil test.

f. The tenant will not mechanically remove any organic material in the form of crop residues left after harvesting of grain crops without the landlords permission.

g. The tenant agrees to adopt and implement a system of crop rotations as developed in cooperation with the landlord.

h. The tenant agrees not to harvest any forage crops after the 1st of September without the landlords permission.
4. Soil Conservation Practices
   a. The tenant agrees to keep all grass waterways, terraces, ditches and tile outlets in good repair.
   b. The tenant agrees to comply with any requirements of the Agricultural Stabilization and Conservation Service such as those concerning establishing conserving cover crops, controlling weeds on set aside acres, which are necessary to maintain eligibility to participate in federal production control and price support programs.
   c. The tenant agrees to maintain any vegetive or structural measures designed to control wind and water erosion, including the maintenance of strip crops, field windbreaks, contours, water control structures and ponds.
   d. The tenant agrees to employ contour farming practices on any slopes that will experience soil erosion if farmed another way.
   e. The landlord agrees to pay the cost of any soil conservation practices required to comply with SCS approved conservation plan for which government cost sharing money is not available.

5. General Stewardship Concerns
   a. The tenant agrees not to graze any timber, woodlands or pastures not normally grazed without the permission of the landlord.
b. The tenant agrees not to cut any standing timber or to engage in any land improvement work, such as the removal of trees or hedges, stream channelization or draining of wetlands, without the permission of the landlord.

c. The tenant agrees to employ alternative methods of roadside vegetation management other than chemical control.
SIMPSON RANCH – 1992
All Farms

Cost per Acre

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>$0</td>
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<td>40</td>
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<td>80</td>
<td>90</td>
<td>100</td>
<td>110</td>
<td>120</td>
</tr>
</tbody>
</table>

Fertilizer

Note: CRP + Set aside (not planted acre)
THE GREEN REVOLUTION SIMULATION

Developed by:
Ricardo J. Salvador

Audience: Educators
Objective: To study the green revolution
To explore the consequences of technology
To examine how different people would respond and react to components of the green revolution
The Green Revolution Simulation

World Food Issues
Agronomy 241
Technology and Social Change 241
University Studies 241

Background Information

The state of Punjab (from Persian "Land of Five Rivers") is located in northwestern India, covering a land area of 19,495 mi² (about 35% the land area of Iowa). The entire state is gently sloping, and consists primarily of agricultural land (only 2% of the state's area remains wooded). Punjabi climate is continental, with rainfall regime ranging from the semi-arid to the subhumid. Most of the rainfall (70%) occurs during the monsoon season of July through September, while 15% of the rain falls during the period December through March. June temperatures average 93 F, while December temperatures average 55 F. Punjab was created in 1966 by partitioning previously existing states on the basis of a common language, Punjabi. Sixty percent of the inhabitants are Sikhs, an Aryan people whose presence in the region dates to ca. 1500 B.C., and who are mostly followers of a faith that combines elements of Hinduism and Moslem beliefs (Sikhism). Twenty five percent of the state's population lives in cities, while more than 70% depend on agriculture for their livelihood. Population growth rate for the period 1961-71 was 2.2%, in spite of the unfavorable gender ratio of 871 females per 1000 males.

The Phenomenon

During the 1960s, Punjab became the bread basket of India as a result of the adoption of a technological package referred to as the Green Revolution. The major elements of this package included improved seed, inputs of fertilizers and pesticides, and irrigation. Whereas Punjab represents only 2.9% of India's cultivated area, for the year 1969-70, the state produced 7% of the country's food grains, and 24% of its wheat. To enable Green Revolution agriculture, Punjabis have developed extensive irrigation systems (67% of the arable land is irrigated). The state has no mineral or fossil fuel sources.

The Scenario

For the purpose of this simulation, you will adopt the role of one of the important players in the development of the Green Revolution phenomenon. Following is some general information that all players need to be aware of. In addition, you will have some additional information about the specific role that you will play. The objective of the simulation is a) to help you understand some consequences of the Green Revolution technology, and b) to help you develop insights about the reasoning process of the various players in the scenario.
Wheat Varieties

There are two types of wheat varieties to choose from, land races (LR) and the new high yield cultivars (HYC) of the green revolution. HYCs have a high yield potential, whereas LRs have strong yield stability. If you use LRs, you hold back some of your previously harvested seed and do not need to purchase seed each year. If you choose to plant HYCs, then you must purchase the seed for $20 per bushel. The recommended seeding rate of HYCs is 2 bushels per acre. You need to purchase new HYC seed every third year.

Irrigation

You must decide whether you will irrigate. To be able to irrigate, you must install a tubewell. Each tubewell will cost $1,700 to install and will pump enough water to irrigate 25 acres. Each irrigation will cost $3 per acre. A typical full schedule for wheat would require four irrigations per growing season. A farmer will base the decision to irrigate on weather factors. You will be provided a weather index (W) to indicate how favorable weather has been for wheat production. An index of 5 means very poor and dry conditions, whereas the top index of 1 means excellent conditions. If you have the capability and have decided to irrigate, you will figure your frequency and cost for irrigation as follows: subtract 1 from the weather index of the given growing season and this will be the number of irrigations needed to preserve potential wheat production at the optimum level (i.e., as if the weather index had been 1). For example, suppose the weather index were 4. You would then need 3 irrigations. Multiply 3 irrigations times the cost per irrigation (3 X $3 = $9) and then multiply this cost times the number of acres you irrigated. This will be your cost. Then, figure your yield for the given season using a weather index of W = 1.

Fertilizer

You must decide if you will apply fertilizer. You can apply fertilizer at three levels, coded by the index I ranging from 1 to 3. When I = 1 you apply 80 lb. fertilizer per acre. For I = 2 you apply 40 lb. to the acre. For I = 3 you apply no fertilizer. The cost of fertilizer is $0.20 per pound.

Yield

Yield will depend on the type of seeds you use, the weather conditions, and the level of inputs you apply to the crop. The yield potential is 80 bu/acre for HYCs and 30 bu/acre for LRs. Since each type of seed responds differently to weather and inputs, a different equation will be used to calculate yield depending on the seed type you choose to plant. In place of the experience that a farmer would have about cultivars, study the two graphs appended. These describe the relative performance of the two wheat types as affected by weather and input level. Below each graph, you will find the corresponding yield formula.

Labor and Land

You can buy hourly labor or you can generate extra income by selling your labor. Hourly wages are $0.50. You may buy and sell land. Initial land costs are $300 per acre. A tractor costs $25,000. Operation and maintenance of the tractor costs $0.30 per acre per production season.
The Green Revolution Simulation

Role Playing Assignments

The Commercial Farmer

Initial Status: You own your land (500 acres, 480 tillable), you require $15,000/year to maintain your standard of living. You currently have one son, aged 15, and a daughter, aged 9. Each additional son will add $750 to your annual needs, each additional daughter will add $1,500 to the same. Your children will enter college at the age of 18, and tuition and board for each will cost $1,500. You have $35,000 as cash. You have no wells installed on your land. You produce monoculture wheat for cash grain. Each acre you manage will require 5 hours of labor. You own 1 tractor.

Rationale: You desire to accumulate wealth in order to ensure your family's future and maintain your standard of living.

YOUR NOTES:
The Green Revolution Simulation

Role Playing Assignments

The Subsistence Farmer

Initial Status: You own your land (10 acres) and two sows and one ox; the ox assists with field labor and grazes on field margins. The sows feed on your household trash and produce pigs that you consume. You require $1,000 per year to survive. You currently have three sons and one daughter, aged 11, 10, 7, 5, respectively. Male children can assist with field work from the age of 12. Female children assist with child rearing and household chores. Each additional son will add $150 to your annual needs, each additional daughter will add $250 to the same. You have $500 as cash. You have no wells installed on your land. You will attempt to produce monoculture wheat for cash grain. Each acre you manage will require 25 hours of labor. You use land races of wheat and highly value yield stability (dependability). You have divided your land into five equal plots. You live on one of these plots, you rotate four crops on the other four plots, in the following sequence: rice, wheat, lentils, beans. In most years, you can get two harvests. You use the dung produced by your animals to fertilize the wheat crop. You consume the rice and legumes you produce. You may modify your cropping system. If you eliminate rice and legumes from your rotation, you will need an additional $1,000 per year for survival.

Rationale: You have opted for cash grain production as a means to get capitalized and gain access to material goods (radios, televisions, stoves, refrigerators), better health care services, and an education for your children, as characteristic of developed lifestyles. You desire to accumulate wealth in order to ensure your family's future beyond the subsistence level. You desire more children as a way to increase the available labor pool for your farm. You prefer male children since they can assist with field labor, and since female children will require you to accumulate substantial dowrie to make your daughter a suitable wife. You are interested in adopting green revolution technology one step at a time (e.g., first seed, or fertilizer, or irrigation), rather than as a complete package, in order to minimize your risk and initial expense.

YOUR NOTES:
The Green Revolution Simulation

Role Playing Assignments

<table>
<thead>
<tr>
<th>The Subsistence Farmer's Wife</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Initial Status:</strong> You manage the household economy: raise the children, prepare food and maintain the home. You perform all labor manually, with no assistance from power appliances.</td>
</tr>
<tr>
<td><strong>Rationale:</strong> You desire to acquire some cash and appliances in order to reduce the amount of drudgery in your daily life. Male children can assist with field labor, while female children can assist with household tasks. However, you have four children and your living conditions are marginal. You resist the idea of having more children.</td>
</tr>
</tbody>
</table>

**YOUR NOTES:**
The Green Revolution Simulation

Role Playing Assignments

The Extension Agent

Initial Status: You are an educated brahmin who took his agricultural degree from the Punjab Agricultural University. You are of urban background and have never practiced agriculture. You are from a financially privileged background and in addition receive a handsome salary. You are not Punjabi, but were raised in Madras, capital of Tamil Nadu state, as a practicing Hindu. You live in the capital city of Chandigarh and go forth each day, or as needed, to contact your clients.

Rationale: You genuinely believe that converting subsistence farmers to the technological package of the green revolution will improve their quality of life. Therefore, you earnestly advise farmers to abandon their land races and rotation practices in favor of wheat production for the cash market. You argue that cash income will be useful to improve quality of life by making such items as clothes, utensils, appliances and other material goods available. You argue that in the modern world only educated people have a chance to adapt and survive, and that therefore the best interests of the children of the families must be taken into account, and that these interests are not best served by employing the children as laborers. You stress that it will cost much money to raise children in the modern way and to provide them an education. When farmers are reticent to follow your advice, you attempt to persuade them to observe how the lifestyles of neighboring farmers have changed upon adoption of green revolution techniques. You attempt to ease the transition by guaranteeing technical assistance. You encourage these reticent farmers to try the new seed on just a small parcel of their land. You teach farmers about credit and offer to accompany them on their first visit to a banker. One of your gravest concerns is that farmers adopt the entire green revolution package (seed, irrigation, herbicides, pesticides), since you realize that an investment in only seed will most likely be wasted without the necessary inputs or crop protection practices.

YOUR NOTES:
## The Green Revolution Simulation

### Role Playing Assignments

### The Banker

**Initial Status:** You are the lending officer for the main agricultural lending institution in Chandigarh. You are not a native Punjabi, but have moved there from New Delhi. You have $1 million of bank capital to invest in the agricultural sector. You charge 20% interest per year on principal that you loan. The central Indian government of New Delhi is interested in promoting the adoption of green revolution technology, and will guarantee the principal plus interest of defaulted loans made to subsistence farmers who adopt the complete green revolution package for the first time.

**Rationale:** You are interested in making the most use of your bank's money by making loans representing the minimum risk. The government-guaranteed loans make subsistence farmers the most desirable recipients of agricultural credit. Government stipulations for the guarantee to your bank include that the subsistence farmer agree to consult and abide by the technical advice of an extension agent. You therefore make certain that subsistence farmers applying for loans understand this. Your second least riskful clients would be commercial farmers who are improving or renovating their capital investments, since they have sufficient collateral to reimburse any potential loss by default. If a subsistence farmer applies for credit but does not intend to adopt the green revolution package you most likely would not be interested, since this loan would be a highly riskful loan (no guarantee and insufficient collateral.) However, you would encourage such farmers to consider converting to the complete green revolution package, since this would make them eligible for credit (and a guaranteed source of income for your bank.) You refer such farmers to extension agents for persuasion on the agricultural benefits of the new technology.

### Your Notes:
Green Revolution Balance Sheet

<table>
<thead>
<tr>
<th>Item</th>
<th>Units</th>
<th>Price</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>HYC Seed</td>
<td>0</td>
<td>$20.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>Fertilizer</td>
<td>0</td>
<td>$0.20</td>
<td>$0.00</td>
</tr>
<tr>
<td>Tubewell</td>
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<td>$1,700.00</td>
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<tr>
<td>Irrigation</td>
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<tr>
<td>Labor hours</td>
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<td>$0.00</td>
</tr>
<tr>
<td>Land Bought</td>
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<td>$300.00</td>
<td>$0.00</td>
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<tr>
<td>Other</td>
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<td>$0.00</td>
<td>$0.00</td>
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<tr>
<td><strong>Total =</strong></td>
<td></td>
<td></td>
<td><strong>$1,700.00</strong></td>
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</tbody>
</table>

Income:

<table>
<thead>
<tr>
<th>Item</th>
<th>Units</th>
<th>Profit/Unit</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>HYC Seed</td>
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<td></td>
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<td><strong>$0.00</strong></td>
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**BALANCE =** $-1,700.00

Will you use High Yield Cultivars? **Yes**

Non-Irrigable Acres: **0**

Yield calculation (F13) computes yield for irrigated and non-irrigated land separately.
Yield Performance of Wheat as Affected by Weather and Input Level

High Yield Varieties

Land Races

Weather Index

Y = P \cdot \frac{1}{W} \cdot \frac{1}{I}

Y = \left[ P \cdot \frac{1}{W} \cdot \frac{1}{I} \right] + 15

Where:
- P = yield potential (HYV = 80, LR = 30)
- W = weather index (5 = poor, 1 = optimum)
- I = input level (3 = none, 2 = medium, 1 = high)
THE USE OF DECISION CASES IN AGRICULTURAL EDUCATION & RESEARCH

Developed by:
Steve R. Simmons
R. Kent Crookston

Audience: Educators and Researchers in Agriculture

Objective: To become familiar with Decision Cases as a methodology

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THE USE OF DECISION CASES IN AGRICULTURAL EDUCATION AND RESEARCH

Introduction

It has been estimated that most persons make as many as 1,000 decisions per day. Most of these decisions are trivial but some may be momentous. Helping students become better decision makers when faced with dilemmas is one of the desired outcomes of education in colleges of agriculture. Employers often attest to the high level of technical knowledge possessed by graduates, but these employers frequently cite lack of confidence and experience in integrating and applying knowledge in the process of making decisions as a weakness in contemporary higher education.

Since the early 1900s the Harvard Business School has employed decision case studies to provide a more realistic focus to the education of business administrators. The Harvard MBA program was established on the premise that "wisdom" in making decisions in business is not readily acquired through passive, lecture-dominated educational approaches (Gragg, 1940). Over decades of experience the decision case concept has proven to be excellent for directly engaging students in dilemmas and tough decisions inherent with the profession of business administration.

Most people associated with education in agriculture have experienced or employed "case studies" in some form during their student or teaching careers. These "cases" may have been in the form of simulations or problem sets, field trips, role play, or a descriptive critique of a professional problem or dilemma. However, most agricultural cases have not been decision cases. Since 1987, the University of Minnesota College of Agriculture has been adapting the natural resources, food science/nutrition and the environment. This effort culminated in the establishment in 1991 of the Program for Decision Cases within the College. To date, over 30 decision cases have been developed at Minnesota covering a wide range of agricultural disciplines. In addition, a "capstone" course considering integrated crop management has been created and formatted entirely around decision cases.

What are decision cases?

Decision cases can be described as "a documentation of reality." They are like a snapshot of a situation or dilemma that requires that a decision be made. A decision case is developed in such a way as to allow students to become a "participant" in the situation and to become fully engaged in trying to resolve the dilemma and reach a decision. All of the agricultural decision cases developed at Minnesota thus far have been written in narrative text with supporting exhibits. However, we intend to experiment with video and interactive computer-formatted cases suitable for alternative audiences such as primary and secondary level students and distance education users.
A decision case usually includes:

- identity and role of the decision maker
- background information on the organization or industry in which the dilemma is set
- delineation of the principal issues in the case
- establishment of the objectives of the decision maker
- delineation of evident decision options
- exhibit materials that provide background data and support information needed by the decision maker. Some exhibit materials may be presented in formats such as video or slides.

Decision case deliberations are highly structured and purposeful. Students are often assigned a case with sufficient time to develop options and to define their decision position prior to the class. For the actual classroom (or extension audience) deliberation of the case, an Interpretive Note is prepared to help guide the instructor-user. This Note is not made available to the students. It provides information to the instructor regarding objectives for the case, suggested uses of the case, questions that can serve to guide discussion of the case, and the case developer's personal interpretation of the key case issues, questions and decision options. The Note may also include a summary of the decision made in the actual case. If so, it is important that instructors who choose to share the actual decision outcome avoid making that decision the "correct" decision in the minds of the students.

What are the outcomes of using decision cases in education?

Decision cases are noted for their strength in helping students to achieve "higher order" educational outcomes such as critical thinking, problem solving and the exercise of mature judgment. It has been suggested that the case approach to education is less efficient for transferring specific knowledge (Dooley and Skinner, 1977) since considerable time is spent in discussion in order to achieve resolution of the case. However, our experience suggests that specific knowledge presented in the context of a case and its deliberation is assimilated more easily and is better retained. Thus, the decision case can be a powerful tool for helping students acquire knowledge on a selective basis.

We have found that decision cases produce an atmosphere of interest, curiosity, and informed debate that goes much beyond that achieved through many other educational approaches. Decision cases often produce intense discussion. Some cases precipitate arguments and disagreements, and students sometimes find it frustrating that there is not
a specific "right" decision. Cases usually lead to elucidation of several plausible possibilities, each standing the test of sound reasoning and technical validity. Students often learn that no solutions to some situations are totally satisfactory. Nevertheless, a decision must be made despite lack of data or clearly favorable alternatives. Through it all, students of decision cases must approach the case through the "mindset" of the decision maker. This often requires that they set aside their personal biases. Deliberating decision cases therefore can aid in building new understanding when a case involves divergent viewpoints on an issue.

Decision cases, as used at Minnesota, are often coupled with student writing or speaking exercises. Cases are an effective method of enhancing writing or speaking across the curriculum. Research is currently underway within the Program for Decision Cases to further exploit these opportunities.

Although decision cases are traditionally employed in conventional classroom settings, we are finding very positive results in using them in extension education settings as well. Extension audiences often are quite responsive due to their high interest in practical examples, as provided in a case, and the opportunities that a case provides for drawing upon the professional experience base of those audiences. Decision cases are a key feature of the new dairy extension initiative in Minnesota.

What are the outcomes of using decision cases in research?

Agricultural researchers focused on "hard science" are accustomed to using deductive approaches to testing hypotheses and resolving problems. Cases, on the other hand, are an example of inductive research. Cases can be a valuable tool for a researcher who desires to address topics that cannot be approached using traditional deductive techniques. Cases are especially appropriate for use when the element of human behavior is a component of the research problem. Cases, by their nature, require a multifaceted or holistic consideration of a problem. Most cases cannot be replicated, but they still represent a valid and often valuable experience. The decision case offers a means of presenting, interpreting and publishing such experiences so that other researchers can gain access to those experiences or insights. As the number of published decision cases concerning a particular topic or issue increases, it may be possible for researchers to draw broader conclusions from the combined interpretation of the cases.

A second research application for decision cases is to generate hypotheses for further testing. By researching and developing a decision case on a particular topic, an investigator can better define the problem and identify areas of particular information need. Such a need can then be investigated further, often using conventional deductive approaches.

Decision cases as a decision making tool

Decision cases have considerable potential for assisting the process and enhancing the effectiveness of contemporary decision making involving unresolved issues. We have
termed this use of decision cases "now-casting." The process involves identifying and rapidly researching/formatting significant and compelling current decisions. A now-case then is administered to individuals or groups of persons with interest and expertise related to the decision and its outcome. These individuals/groups take on the role of the decision maker in the case, and propose thorough and creative decision options along with their rationale for each. They also may recommend a specific decision or course of action. The chief advantage of now-casing to aid the decision making process is the opportunity that it provides to engage people directly in the decision-making process, complete with background data and information. Those deliberating the now-case play more than the role of a critic in that they are asked to take on the role of the decision maker at a very specific level. As noted earlier, such an approach can aid in building understanding and achieving synergy between individuals and organizations with divergent or opposing viewpoints on an issue.

How does one develop a decision?

A decision case tells a true story with the decision maker at the heart of that story. The form of narrative in a decision case differs greatly from the usual scientific writing style. Good cases often employ stylistic elements common to the media or journalism in order to help capture the reality of a case situation. When writing a case, the developer usually references exhibit materials as background information and to enhance the capability to analyze the case issues. These exhibits are often presented in as close to their original form as possible, again to enhance the perception of reality in the case.

Dilemmas or problems for possible development into decision cases are everywhere. The difficulty is winnowing these options in order to select the best for development. Early in the case research process, permission should be obtained from the decision maker and his/her organization (if applicable) to develop, use and publish the case. Some sensitive cases are "disguised" in order to protect the identity of the decision maker or organization. Most decision cases at Minnesota have been reviewed in their final form by the decision maker and his/her organization prior to their use or publication. A case release form is usually signed by the decision maker prior to publication or use of the case.

Summary

Decision cases are an established pedagogical approach for education in business that is being successfully adapted for use in education involving food and agriculture, natural resources, and the environment. Decision cases are particularly effective for enhancing student problem solving, critical thinking, and decision making skills. They can also effectively assist students to acquire and retain specific technical knowledge. Although in their infancy, decision cases in agriculture appear to have a bright future for education and research applications, as well as for assisting and enhancing the process of decision making involving contemporary problems and dilemmas.
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TEACHING WITH CASES

Developed by:
Steve R. Simmons

Audiences: Educators in both formal & non-formal educators

Objectives: To understand how to teach with cases

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TEACHING WITH CASES

Steve R. Simmons
University of Minnesota

Introduction

Decision cases are a special kind of case study that focuses on a real dilemma viewed from the perspective of a decision maker who must wrestle with a decision arising from that dilemma. The case is written in a way that the actual resolution of the case is not revealed but is withheld in order to permit the students to assume the role of the decision maker and to formulate their own decision responses and rationales. Although subtle, the power of a decision case is in the way it causes students to look at the dilemma from the perspective of the decision maker, not to merely act as critics or judges of the decision maker.

Much of the information written about decision cases concerns their development. Less is available concerning strategies and techniques for using cases in the classroom or for extension education purposes. This paper is intended to provide thoughts on teaching with cases based on my experiences in using decision cases in classes since 1990. It is intended only to discuss principles and illustrate strategies for using cases. The Program for Decision Cases at the University of Minnesota is currently exploring new options for development and use of decision cases in secondary education, higher education and extension education. Each educator who uses cases will want to experiment to find the approach that is optimal for them.

Physical arrangement of the classroom

Classroom physical arrangements on most university campuses confirm the fact that university education is dominated by lecture. Classes are usually arranged as "rows and columns" of students with the teacher as the focal point. Such formally-structured classroom settings can be deadly to effective case teaching. When requesting a classroom for teaching a course using cases I always seek one where the capability exists to create a seating arrangement more conducive to discussion. A common approach I use is to place the students in a "U" or horseshoe-shaped arrangement where they can effectively see each other and where the teacher can get close to the students in the class. Case teachers often

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move about the room while discussing a case. A "U" arrangement of students facilitates such movement without affecting the students' abilities to see the teacher and each other. Some case teachers use a "round table" or conference table arrangement, especially if the class size is small. In such instances the teacher often remains seated at the table with the students during the case discussion unless s/he wants to use the blackboard or overhead projector to record points about the case.

Case teaching style and strategy

Case are usually taught using a discussion-focused and participatory style. Teachers who are accustomed to lecturing and "professing" will find case teaching a very different experience. One of the pioneer case teachers at the Harvard Business School, C. I. Gragg, summarized this difference well in his classic paper titled Because Wisdom Can't be Told (Harvard Alumni Bulletin, October 19, 1940). He stated:

"A badly handled case system cannot but be an academic horror. Improperly handled, a case is merely an elaborate means for confusing or boring students. If, moreover, the teacher insists on being a patriarch—with the only right answers—and if the teacher visualizes his or her task as one of forcing the students...the out and out lecture system is infinitely less costly and less straining to everyone concerned. Such use of cases perverts the unique characteristics of the system. The opportunity that the [case] system provides the students, of reaching responsible judgments on the basis of an original analysis of the facts, is sacrificed."

Some refer to the role of the case teacher as analogous to that of an orchestra conductor whose students as the musicians. The teacher is not "playing the instruments" but rather assuring that all the musicians play their instruments to the limits of their abilities and contribute to the overall effort. There are occasions during a case discussion when a teacher may briefly assume the role of "lecturer" and expand upon an aspect of the case where they may have specific expertise, but such times as not commonplace. Most of the time a case teacher is questioning, redirecting questions, clarifying, probing and noting points or issues on the blackboard or overhead projector.

Discussion teaching, and thus case teaching, is not easy. A case teacher must cultivate the ability to think ahead and listen at the same time. Case teaching should not be rambling or non-focused. Planning ahead "on the run" during the case discussion is essential to maintaining a coherent case experience. The instructor should have a well-defined plan in mind before beginning the case discussion. Usually the case Teaching Note outlines a sequence of possible questions that can help guide the discussion. Obviously, the teacher can deviate from this "script" as s/he sees the need. No two discussions of a case are ever the same, which adds to the interest and value of the experience for both the
student and the teacher.

We all have had the experience of untying a troublesome knot in a string or shoelace. We pick away at the various strands in the knot with our fingers until it finally unravels. Case teaching is a lot like unraveling a knot. I like to think of the teacher as "teasing" the case. A case dilemma is like a complicated, troublesome knot in one's shoelace. We as teachers, along with the students "pick away at" or "tease" the issues in the case from various angles and perspectives until the elements of the dilemma and decision become more clear to the students. The comparison of case teaching to unravelling knots breaks down in that many case dilemmas cannot be fully "resolved" to everyone's satisfaction. Nevertheless, a decision still must be made. Thus, the decision "knot" is usually better understood as a result of discussion of the case, but it often is still a knot in the end.

I have found that three basic questions are important to address during most of the case discussions that I lead:

a. Why is this case a dilemma?
b. What are the objectives of the decision maker?
c. What are the options of the decision maker?

I, as teacher, need to think through these questions ahead of time and determine issues and points that I want to see discussed. Yet I must remain willing to be "surprised" by some new insight or perspective on the case that I may not have previously considered. I have taught some cases a number of times, but I still find that students see something new each time that I teach them.

Assigning, engaging and responding to a case

Most cases in academic courses are assigned several days before the in-class discussion so that students have an opportunity to familiarize themselves with the case. Some shorter, simpler cases can be assigned and discussed within a single class period.

One challenge to using decision cases with extension audiences is that the case can seldom be assigned ahead of time. When a case must be assigned and discussed within a single class period or extension meeting, it is important that the teacher/extension educator have a strategy for rapidly familiarizing the students with and engaging them in the case. Often an overview by the instructor is sufficient to introduce the students to the case principals and issues. Some instructors read the case aloud with their students, if it is not too long. A teacher can divide a class or extension group into smaller sub-groups and ask each group to read the case over together and discuss it before re-convening the entire class or group. Use of videos or slides in introducing a case are often helpful to assist students to visualize the dilemma and decision maker.

When a case is assigned ahead of time, there are a number of ways that students might be expected to engage and respond to a case prior to the in-class discussion.
Sometimes questions are distributed with the case with the expectation that the students will answer them before the class discussion. An instructor can require that individual students or groups of students prepare a detailed analysis and decision response in writing or orally to be handed in or presented at the time of the class case discussion. In one course that I teach using a number of decision cases, each case is assigned several days in advance and the students work together in small groups (3 to 4 students) prior to the class discussion to prepare a 10 minute video depicting their case analysis and response. At an appropriate time during the class discussion the students are asked to share their videos with the other students and the instructor. These detailed written or oral case analyses/decision responses are evaluated and form a basis for grading in the course. Small group cooperative learning strategies are a powerful tool for case teaching since they allow the diversity and complemental backgrounds and knowledge of the students to enhance their abilities to respond to a case dilemma. Students can learn much from each other.

Summary

Case teaching involves guiding students through a maze of issues and factors bearing on the case dilemma and decision. Case teaching is based on discussion and inquiry. Case teachers relinquish some of the tradition role of "expert" in order to better draw students into the discussion and cause them to take "ownership" of the case. How students engage and respond to the case before the class or extension group discussion is an important aspect of effective case teaching.
# Table of Contents

Foreword ................................................. v
Acknowledgements ...................................... vii

Papers:
1. Introduction ........................................ 1
2. Decision Cases in Agriculture .................... 6
3. A Case for Case Study .............................. 12
4. Educational Objectives ............................ 14
5. What are Decision Cases? ......................... 16
6. Decision Cases as a Teaching Component ........ 20
7. Decision Cases as a Research Tool in Agriculture 24
8. Decision Cases for Extension Teaching ........... 29
9. Decision Cases to Facilitate Creative Decision Making 31
10. McNair on Cases .................................. 33
11. Every Teacher a Casewriter ...................... 39
12. How to Prepare Decision Cases .................. 42

Selected References for Decision Cases .................. 48

Summary of Cases ........................................ 49

Cases:
1. Dick and Sharon Thompson’s "Problem Child" ..... 50
2. Mueller Farm: Lupin as an Alternative Crop ....... 55
3. Agricultural Manager’s Dilemma at St. Croix Valley Foods, Inc. 61
4. Stratton Farm: Case of Conservation Compliance .... 72
5. The Gustavson Farm ................................. 79
6. The Metz Farm ..................................... 87
7. Carpenter Orchard .................................. 99
8. A Pioneer With Nitrogen ............................ 124
9. The Containment of P. Sorghi ...................... 142
10. The Abel Family Farm ............................. 159
11. The Worth of a Sparrow ............................ 168
12. AgriServe Crop Insurance ......................... 194

List of Cases Prepared at the University of Minnesota .... 218

Procedures for Ordering and Copying Cases ............... 219

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Extension audiences are changing. They have more education, are more sophisticated, and prefer more depth in educational programming. Traditional subject matter based programming is losing appeal. The workshop setting with more "in depth" learning is preferred. Participants are requesting more training in problem solving skills to meet the competitive challenges of agriculture.

Decision case learning provides an excellent teaching method to meet the needs of extension clientele where problem solving skills are the desired outcome. Stimulated by 80 years of success at the Harvard Business School, the use of decision cases is common in business schools and company training programs in the United States and in many other countries. The use of decision cases in agriculture is relatively new but has met with excellent results. Decision cases have provided a potent "real world" experiential learning opportunity in College of Agriculture classrooms at the University of Minnesota. Application of decision case learning for agricultural extension seems logical and has proven fruitful on the limited scale that it has been used within the Minnesota extension education system.

For many years extension educators have used clinical, simulated, or descriptive cases, all of which are excellent means of stimulating interest and reinforcing subject matter teaching. The difference between the clinical, simulated, or descriptive case and a decision case is subtle. Clinical, simulated, or descriptive cases provide an effective means of learning the relationships between scientific facts but do not address the people issues. Although helpful, this approach is often lifeless and does not provide sufficient reality from the perspective of the decision maker (farmer) to accurately understand or anticipate the stumbling blocks of either the successful application of new agricultural technology or implementation of problem solving at the farm. Decision cases, on the other hand, not only deal with the scientific aspects of solving problems and implementation of new technology at the farm but also include for consideration the feelings, concerns, values, and goals of the decision maker (farmer).

It is felt that better appreciation of the people issues is the missing link in achieving technology adoption and improving problem solving success in agriculture today. Therefore the use of decision case learning should improve the effectiveness of extension education.

Decision case learning is not right for every extension teaching situation. For example, it is not particularly useful in teaching the basic principles of dairy nutrition, reproductive physiology, or mastitis control. It is extremely useful in teaching the application of those scientific principles within a "real world" context of a problem solving situation.

There has been expression of concern by some extension educators about the use of decision cases with farm audiences. It is felt that farmers may not have the necessary study time in an extension meeting format to adequately prepare for a meaningful discussion. This concern is legitimate. However, as is the case in the application of any teaching method, decision cases must be geared to both the participants' level of expertise as well as the teaching situation. Decision cases for some extension audiences will need to have less detail and fewer exhibits than for campus classes. Slides and video segments of the case farm being discussed are helpful enhancements in communicating the issues in the case. Where it is anticipated there may be a great variation in reading skill and speed among participants, the cognitive process can be facilitated by the instructor reading aloud the narrative of the case while the participants follow along and mark what they believe are the significant facts and issues in the case. There are certainly other creative teaching techniques that can be used to facilitate decision case use. Our experience has shown that where proper

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pre-assessment has occurred, and where the decision case design and discussion is geared to the participants' level, decision case learning is easily adapted to extension education applications.

During the winter and spring of 1991–1992 a series of six 4–hour dairy diagnostic workshops for dairy professionals were conducted at six locations in Minnesota. Decision case learning was successfully used during these workshops. Since then decision cases have been used in other extension educational settings with excellent results.

The advantages of decision case learning in extension educational applications are that:

1. The decision case captures the intrigue of the participants and results in lively discussion. This creates an excellent workshop atmosphere with active learning rather than passive learning predominating.

2. The decision case discussion gives access to the vast experience among all participants, not just the instructor. In this educational setting participants learn as much from each other as they do from the course instructor. This builds confidence not only in themselves but also in their colleagues and fosters community team building.

3. The decision case approach is relevant to the "real world" experience of extension clientele. It fosters a "systems" approach to farm problems rather than a more narrowly focused discipline approach.

4. The decision case approach does not insist on "the single solution(s)," and thus encourages participant creativity, resourcefulness and independent thinking.

5. The decision case discussion gives participants confidence in their own ideas and empowers them with practical problem-solving skills they can immediately use on their own farm or business.

6. The decision case approach allows practice in applying problem solving skills within the context of a "real world" setting without risk of disaster.

7. The decision case approach considers the people issues (goals, values, biases etc.) that have not previously been given adequate attention.

8. The more casual style of decision case teaching lends itself to interdisciplinary team teaching, thus providing sufficient subject matter expertise where decision cases cross several subject matter disciplines. Yet the participants still benefit from a more realistic and comprehensive problem solving experience rather than a fragmented, narrowly focused, discipline approach which has been criticized as "ivory tower" and impractical in the past.

There are some disadvantages to this educational approach that should be recognized.

1. It takes more time to use a typical decision case. This requires a change in the normal format of traditional extension meetings. The workshop is the preferable setting.

2. Decision case teaching requires that the instructor be well prepared and has sufficient experience to accurately and skillfully direct the discussion and deal with a broad base of subject matter expertise. This may not be the teaching method of choice for the beginner.

The application of decision case learning in extension education holds great promise. Where properly used it can be expected to provide an effective active learning atmosphere in which participants are empowered with practical problem solving skills.
How to Prepare Decision Cases

by Melvin J. Stanford

Decision case research and writing is a combination of science and art. There is a scientific responsibility in the preparation of a decision case to represent reality and to eliminate or minimize bias, just as there is a scientific responsibility in empirical research to demonstrate relevance and representativeness through statistical methods. While it is not possible in a case to represent the entire decision-making process, a good decision case should include the most essential elements of information on which the decision maker based, or would base, a decision about the issues. The art of decision case preparation lies in assembling the material and writing it in such a way that both teacher and students can understand the issues in the case, find enough information with which to analyze those issues, and maintain a reasonably sustained interest in studying the case. In addition to representing the reality of a particular situation, the case should enable the student to identify with the decision maker so as to be able to develop insight and propose action from that point of view.

The art of case writing at Harvard Business School has reportedly been developed and preserved primarily by the apprenticeship method. There does not appear to be available any single publication which can serve as a comprehensive reference for case research and writing. The selected references following this paper represent a useful variety of information on the subject. On the basis of those references, the other materials in this book, and the experience of the authors, some guidelines can be offered.

Before You Start Writing

1. Study some well-written cases and case books. Harvard Business School produces a larger number of cases each year than any other organization, and they are of consistently excellent quality. There are also good cases from other sources but with a wider variation of overall quality. The Case Research Journal, published by the North American Case Research Association and McGraw-Hill, contains refereed cases.

2. Enroll in a case-writing seminar or workshop if possible. There are case workshops conducted regularly in the United States by the North American Case Research Association, the Southwest Case Research Association, the Academy of Management, the Midwest Society for Case Research, the Decision Science Institute, and perhaps others. The University of Western Ontario offers a case writing program in Canada. Several case seminars have been conducted by agricultural faculty of the University of Minnesota in connection with professional agricultural meetings.

3. Use some decision cases in your classes, if you can get some to meet your needs.

A Case Development Process

1. Determine course objectives and/or research objectives.

2. Decide on specific teaching objectives for a class or section of the course, or research objectives for a particular project.

3. Identify the concepts, issues, and decisions related to teaching or research objectives.

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4. Review any printed cases that may be available on the subject. If you can’t find what you want, then a good option is to write your own. That is how many new cases get written, to fill a perceived need that other cases can’t meet.

5. Seek research support.

6. Select an organization for the case, such as a farm or a business firm. It is often helpful to consider several. They are not hard to find. Many people are willing to share their knowledge and experience with a researcher for educational purposes if they are treated with respect and interest. An important key to eliciting cooperation is attention to the decision-maker’s goals, priorities, and point of view.

7. Discuss and reach agreement on access to data. It is important to obtain a written release for unrestricted educational use of the case when it is completed. Most individuals and private organizations have some sensitivities about personal or financial data. However, a case can often represent certain decisions and issues without disclosing sensitive data. Where it is important to have sensitive data for the authenticity of a particular case, it may be possible to disguise the data without distorting the realism of the issues and the decision situation.

8. Interview the decision maker, if possible. Try to obtain copies of written information pertinent to the issues to be decided (or that were decided). Keep notes of questions and replies.

9. Make an initial selection of what information is to be conveyed to students or to other users of the case. Quantitative data, and some kinds of background information, are good candidates for exhibits. Qualitative data make good material for the narrative body of the case.

10. Write an initial outline of the case, laying out the broad concepts.

11. Arrange the exhibits in the approximate order in which you want to first refer to them in the case.

12. Write a draft of the case, with reference to the outline and the exhibits.

13. Write a draft of the discussion questions you want to assign the students or other discussants and your interpretation of those questions and the case, using only the information you have included in the case. This is the material which become the main substance of the teaching note, or instructor’s manual (see “Every Teacher a Case Writer,” paper #11), which may now be written in draft form.

14. Rewrite the case and instructor’s manual as many times as you need in order to reach initial satisfaction with them. As the case takes form, any gaps in the logic, the data, or the flow of information will usually show up, and it will be necessary to get additional pieces of information to fill those gaps. This can be exasperating because, on the one hand, you want to have the case accurate and representative, and on the other hand, to get it perfectly accurate and representative would probably take more time, energy and patience than most of us have. At some point you will have to stop your additional research and say, “Enough!” (However, you can expect that reviewers will suggest, and perhaps editors will require, some additional research and rewriting which you hadn’t thought of up to that point).

15. Review the case (not the instructor’s manual) with the subject of the case, edit or revise it to their satisfaction, and seek to obtain a written release for unrestricted educational use. It may even become necessary to disguise the case at this point, even if the case subject didn’t request it earlier. Disguising a case to get it released is usually better than abandoning the case.
16. Test the case in the classroom, as a regular assignment for students, or in a discussion with colleagues or other intended audiences. Then revise it on the basis of what was brought out in the discussions.

17. Submit the case and instructor's manual for peer review, preferably double-blind as for a paper or journal article, for presentation or publication. Some of the organizations mentioned above, that offer workshops and seminars, are prospective outlets for publication: the Case Research Journal is published by the North American Case Research Association; Annual Advances in Business Cases is published by the Midwest Society for Case Research. Some agricultural organizations are now reviewing and publishing decision cases: the Journal of Natural Resources and Life Sciences Education, and HortTechnology, have published several decision cases and papers about the case method (see Cases 1-4 and Papers 3 and 6 in this book) and presently have other case materials in the review process.

18. Consider other means of publication or distribution. For example, some of the cases prepared at Minnesota have been initially published as extension service working papers.

Case development situations do not necessarily fit neatly into this particular sequence. Some flexibility is needed. But the process will work. The cases in this book have generally followed this approach. I will comment on one of them, the "Gustavson Farm," in relation to the steps described above.

Illustration

The "Gustavson Farm" (case #5) situation was known to entomologists in the university extension service. There were a lot of grasshopper infestations in the state of Minnesota in the years 1987-1989, resulting in some serious problems for farmers. When the need was identified to develop a case involving the use of toxic pesticides on farms, the Gustavson situation was mentioned as one which had some unusual complexities. It was by then established that there were some objectives for classroom use, extension course use, and sustainable agriculture research that could possibly be met by a case about the Gustavson situation. Steps 1, 2, and 3, in the development process were somewhat in place. As to Step 4, it was already perceived that there were no decision cases available about toxic insecticides. There was already some research support, Step 5.

In Step 6, the Gustavson situation was reviewed to determine which of the farmers involved had the more central role of decision maker for the issues. All of the farmers had to make decisions, but it appeared that the decisions that had to be made by Mr. Gustavson were perhaps more complex and more central to the overall issues of the situation than were the decisions of his neighbors. Information on file pertaining to the grasshopper situation in that part of the state was reviewed, along with references on crop yields and prices and toxic pesticides. Several of the farmers had been interviewed previously. Mr. Gustavson was interviewed again and provided further information (Steps 7 and 8). At that point it was necessary to lay out all of the information on hand to determine what should be made available to students and other case discussants (Step 9). Essentially, it was necessary to communicate to users of the case, (a) the past damage by grasshoppers, (b) the present threat of damage, (c) the range of potential values of the neighboring crops, (d) the cost of grasshopper control options, (e) the values and objectives of the parties involved in the situation, and (f) the power and complexity of community and individual sentiments about the issues.

A general outline was prepared (Step 10), which followed a customary sequence of introduction, background of the farm, conservation reserve information, grasshopper history, control methods, the present grasshopper threat, and alternative actions available to Mr. Gustavson. Then, six
exhibits were selected: (1) photos of the crop damage the previous year, (2) crop yields and prices, (3) grasshopper control action levels, and (4-6) insecticide labels, with characteristics and toxicities. The case was then drafted (Step 12), with the title, “Grasshoppers on Conservation Land.” The discussion questions and authors’ interpretations were prepared and the instructor’s manual was drafted (Step 13). Analysis of the quantitative data included a range of possible values of the total crops at risk, depending on assumptions about crop yields and prices which could not be known in advance of harvest. Rather than work out all possible combinations, the authors calculated the outcomes of some of the assumptions in such a way that the seriousness of the grasshopper threat was clear and so that students or others could follow the same pattern to explore the effects of any other assumptions.

The case and instructor’s manual were then rewritten several times (Step 14), and during the process several phone calls were made to various parties to clarify information. The case was then cleared with the subject (Step 15). No request for disguise had been made at that point, but the case had not been reviewed by anyone other than the decision maker. The case and instructor’s manual were submitted (Step 17) for review for possible presentation at a case workshop prior to being used in the classroom, and they were accepted. At the workshop presentation, some commentators remarked that the outcome of the case appeared to be a foregone conclusion, with no real decision to be made. Since that was not really true, the authors obtained some additional information (mostly about the town sentiments), showing why the decision was not one which Mr. Gustavson could easily make. The case was then used in several classes and seminars (Step 16).

It was also submitted (Step 17, again) for publication in a refereed journal. The case was accepted for publication, but a reviewer and the editor felt that, because of the sensitivity of some of the issues and observations in the case, it should either be cleared with all of the farmers involved or else disguised. The authors did not know whether all of the farmers would approve the case without extensive revision, and such revision was not considered necessary to realistically portray the case dilemma. So the choice was made to disguise the names in the case, including the title. Also, the editor asked for an area map, which was provided, and said that the photographs of the damaged crops would not print well, so they were omitted.

Each case will have its own variations from the general pattern. Every case, however, can be approached with the above pattern, and every case undertaken is likely going to be more work in the end than is foreseen at the start. In that way, the development of a good case is not much different than the development of a good paper or article.

Posters

The poster format is commonly used in agricultural meetings to present research findings in summary form (see paper #2). Completed decision cases in agriculture have been presented effectively in poster form to convey the issues of cases and to serve as references in case development seminars. Because the poster format summarizes the essentials of a decision case and its instructor’s manual, the elements of a decision case poster can facilitate the initial preparation and organization of the case materials.

We have used the following outline in the preparation of decision case posters:

**CASE:**

- Identity and information about the Decision Maker
- Background information on the organization, industry, etc.
Issues, decisions to be made, dilemmas

Objectives of the decision maker

Alternatives or options

Essential information for analysis, decision, support; include the basic information on which the decision maker would (or did) make a choice.

List of Exhibits (vital for the design and structure of the case)

INSTRUCTOR'S MANUAL, OR TEACHING NOTE:

Case Objectives (the beginning point of the whole case development process)

Uses of the case

Discussion questions for users of the case

Analysis of the questions and issues (which record the authors' interpretations and indicate the kind of work expected of the students)

General conclusions or interpretations by the authors

The above outline is not meant to illustrate everything that needs to go into a case and instructor's manual, but it does cover the general categories. If used as a guide in planning the research and writing of a case, the outline can help the author(s) gather more complete information and organize it into the kind of literary work that McNair speaks about (see paper #10). For those who have not written cases before, the outline can save time and reduce uncertainty. Veteran case authors tend to use a planning outline or structure, explicitly or intuitively.

Case Writing Conventions

A number of conventions to observe in the preparation of decision cases are mentioned in the papers in this book. The purpose of observing decision case conventions is to create and preserve the unique kind of involving situation that this literary medium portrays. McNair is particularly articulate in describing the "mystique" of a good decision case. The following conventions are proposed as being generally practiced in the most effective decision cases seen in print. An effective decision case typically:

1. Is decision oriented and researched based. "Armchair" cases seldom convey the reality needed to involve the students. A "made-up" case will usually be detected and often discounted by students. There are debates about the relative value of field and library research. Both have value, but it is difficult to prepare a good decision case with library research only. Field research is the preferred source of information, with library research in a supporting role.

2. Is self-contained. Outside research can be assigned students in some situations, but the case should generally stand on its own.

3. Is reasonably current. Some good cases will last longer than others, but it is easier to prepare a case realistically if the issues are current at the time.
4. Is written in past-tense, objective language.

5. Does not identify the casewriter(s) as such.

6. Identifies or quotes the person(s) expressing opinions or interpretations.

7. Excludes footnotes and end notes or references from the narrative of the case. Exhibits are footnoted as to source. Other attributions may be cited in the body of the case, and references may be listed in the teaching note. Footnotes tend to break the flow of the scenario and put students in the position of spectators rather than participants.

8. Is well written and organized. Exhibits are listed in order of first reference and follow the text.

9. Include the basic information available to the decision maker and pertaining to the issues to be resolved.

10. Contains issues powerful enough to get students involved.

11. Is prepared with an instructor’s manual, or teaching note, which is a communication from faculty to faculty, containing the elements in the poster outline (above) and as much as is relevant of the detail described in paper #11. It should be emphasized that the instructor’s manual is not intended to be an “answer sheet” for the case, even though it contains some of the kinds of analyses that should be expected of students studying the case. It is not the purpose of a case class to bring the students around to the professor’s solutions but rather to lead the students to develop their own competent analysis and decisions based on sound principles in the particular situation. In a case discussion, while decisions need to be proposed and supported, the discussion is as important as the decision, and the journey is as important as the destination.
Selected References for Decision Cases


*Harvard Business School Publications on Case Development and Use.* To order copies, call (617) 495-6117 or write the Publishing Division, Harvard Business School, Boston, MA 02163.


A Case for Case Study

Steve R. Simmons, R. Kent Crookston, and Melvin J. Stanford

In 1908, Edwin Gay, the first dean of the newly instituted Harvard Business School, predicted that use of case studies would become widespread in courses of the college (Copeland, 1955). That visionary, and at the time controversial, prediction provided the beginning for what has become one of the most advanced and successful case educational programs in the world. Decision cases developed by the Harvard Business School now number in the thousands and are used in business and management programs at hundreds of colleges and universities around the world.

The recent decision by the Editorial Board of the Journal of Natural Resources and Life Sciences Education to publish decision cases could prove to be as important for stimulating case use in agriculture, natural resources, and the life sciences as Dean Gay's advocacy was for Harvard.

Although agriculture, natural resource and life science educators have long used problems, simulations, and descriptive case situations in their class and extension education efforts, the use of decision cases is relatively new to these fields. Since 1987, the College of Agriculture at the University of Minnesota has been promoting the development and use of decision cases in courses within the college. We have been participants in this effort and, as case teachers, we have found great satisfaction in using decision cases to enrich our programs.

What are Decision Cases? Decision cases have been described as "a documentation of reality." Specifically, a decision case describes an actual (not simulated or contrived) situation or dilemma requiring that a decision be made. Within this issue of the Journal are three decision cases that we hope will be the first of many to be published in future issues. The protocol and format for decision case development and publication are well established within the business and management professions. However, there have been interesting challenges in adapting the concept of decision cases to agricultural or scientific contexts. But our experience at Minnesota, where more than 25 decision cases have been developed to date, has convinced us that case studies are very well suited to our professions.

What is Unique about Decision Cases? The difference between a decision case and other case-like educational experiences that we and others have used is subtle, but profound. The atmosphere of interest, curiosity, and informed debate created by a well-developed decision case serves as a powerful catalyst for student learning and participation. Decision case teaching can be intense. Some cases precipitate arguments and some students are frustrated when the instructor insists that "There is no one right answer." Good cases usually lead to several plausible or compelling decision possibilities, each standing the test of sound reasoning and technical validity. Most importantly, students learn that although more data would be desirable and that no perfect solution seems to exist, a decision still must be made. Such is the stuff of decision making in the "real world." The more that we can prepare students to function in such situations, the better professionals they will be.

A former Harvard case teacher, Charles Gragg, wrote a classic article entitled "Because Wisdom Can't be Told" (Gragg, 1940). In it, Gragg maintained that

the mere set of listening to wise statements and sound advice does little for anyone. In the process of learning, the learner's dynamic cooperation is required... students are provided with [case] materials which make it possible for them to think purposefully. They are not given general theories or hypotheses to criticize. Rather, they are given the specific facts, the raw materials, out of which decisions have to be reached in life and from which they can realistically and usefully draw conclusions [italics added for emphasis].

Gragg proceeded to make a convincing argument that decision case educational experiences lead to the development of professional "wisdom."

Why Publish Decision Cases? Although agricultural and other scientific educators might conceivably publish cases in business-oriented journals, it is unlikely that they would have the readership of those published in a forum

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Journal Requires Format for Decision Cases

Contemporary interest in providing problem-solving and decision-making experiences in education has prompted the adaptation of decision cases to agricultural, natural resource, and life science situations. At the 1990 annual meeting of the American Society of Agronomy, the Journal of Natural Resources and Life Sciences Education Editorial Board approved the publication of decision cases suitable for use in classroom or extension education situations. The following guidelines describe the format for publication of decision cases. Prospective authors will find it helpful to consult these guidelines before submission.

Decision Case Guidelines in the Journal of Natural Resources and Life Sciences Education

I. Criteria for Evaluation

Primary consideration is given to original cases that describe actual situations (not simulations) requiring a decision. Decision cases should foster integration of concepts, use of problem-solving skills, application of technical information, and/or consideration of human, societal, and ethical factors. Appropriate decision-maker roles for published cases include producers, scientists or other professionals, educators, and policymakers. Criteria for acceptance of decision cases are:

1. Cases must describe an actual (not simulated) situation that advances understanding or teaching of decision making
2. Cases must be thorough and well-documented (e.g., adequate exhibit support) (continued on p. 3)
such as the Journal of Natural Resources and Life Sciences Education. Most importantly, it is imperative that a large number of high-quality decision cases in a number of disciplinary contexts be developed and shared if the use of decision cases is to proliferate in agriculture, natural resources, and the life sciences.

Case development and writing is hard work; it requires considerable time and effort to identify a suitable decision maker and decision focus, to research the case background and supporting data, and to elucidate the decision issues and alternatives. Such scholarship must have a ready outlet for publication if professionals are to be expected to commit the effort needed to develop cases. Although some modifications are usually necessary to convert a class or extension-tested decision case into a refereed manuscript, it is one of the best options available for informing other professionals about the case, its attributes, and its potential utility for their educational activities. Peer review also helps to assure high and consistent quality for cases that are shared among institutions.

Summary. There has been considerable emphasis of late on the importance of higher-order outcomes in education. Such outcomes include developing students' critical thinking and problem-solving abilities, helping them deal with ambiguity and the assessment of risks, and enhancing their decision-making skills. We have found that decision cases directly and successfully address such outcomes. Decision cases are not equally suited for every educational purpose (Dooley and Skinner, 1977), but they are a powerful part of the educator’s “tool box.” The inclusion of decision cases as a regular feature in the Journal of Natural Resources and Life Sciences Education is a positive step and should help stimulate the development and publication of good cases. We applaud the Journal's action and encourage readers to consider whether they might develop, publish, and use decision cases in their educational and professional activities.

REFERENCES


Your comments concerning the content of this editorial or other published material in this journal are welcome at any time. Please send your letter to the Editor to: David A. Munn, NLE Editor, The Ohio State Univ., Agricultural Technical Institute, 1328 Dover Road, Wooster, OH 44691.

(continued from p. 2)

3. Cases must address topics and issues of interest to a broad educational audience.

4. Cases must be clearly and concisely written

II. Format Specifications

Abstract. A clearly worded abstract of the case situation including description of the decision maker, decision focus, key issues, and case objectives/use. The abstract should contain a maximum of 250 words.

The Case. The case text should be interesting and easy to read. An introductory paragraph preceding the case should set forth the context of the case, including citation of other published cases of relevance to the case being presented. The case description should permit the reader to fully understand the background and specific considerations of the case. The text should allow the reader to readily identify with the decision maker(s) and the decision. The objectives of the decision maker should be evident in the case, either by explicit mention or by inference from other case information. The alternatives or options of the decision maker in dealing with the issues should also be clear to the reader. The concluding paragraph of the case should refocus on the major issue(s). It is convention to write cases in past tense.

Exhibits. Effective cases are usually supported by relevant exhibits. Examples of exhibits include data bearing on the decision, illustrations, background documents, correspondence, etc. Exhibits should be drawn from actual, unaltered sources (exceptions may be made when confidentiality must be protected) and should be referenced in the appropriate places within the case text. Case exhibits should be well-organized and concise and should not contain information that is irrelevant to the case. Exhibits for information taken directly from citable publications should be referenced. Exhibits should be numbered in the same order as they are referenced in the case.

Teaching Note. The teaching note describes the objectives of the case and the principal issues considered. This section of the manuscript should provide the reader a concise interpretation of the significance and educational value of the case. The section should also describe how the case has or might be used in a classroom or extension education context. If the case has been used, the teaching note may provide a summary of student evaluations of the case. The teaching note may also include the author's analysis of the case, although the detail provided in this analysis may be limited to protect the potential use of the case by readers. Educators interested in teaching the case can usually obtain a full copy of the author's analysis by corresponding directly with the author. The teaching note is particularly important for assisting readers in deciding whether or how to use the case.

References. Citable references in the case text, teaching note, or exhibits should be listed. Use the author/year system for citing references.

Abridged Case Format. Some cases cannot be published as complete cases due to their length or complexity. Such cases may be published in an abridged case format. All abridged cases submitted for publication, regardless of length or complexity, must be reviewed in their entirety prior to acceptance. No case will be accepted unless both the complete case and abridged version has been favorably reviewed by the reviewers and editors. Text of abridged cases should be identified as “Case (Abridged).” The text of an abridged case, as well as the teaching note, should be of sufficient length and detail to permit readers to understand the nature of the decision, the identity of the decision maker(s), the principal issues of the case, and the educational value of the case. The abridged text and teaching note should contain sufficient information to allow readers to assess the potential for use of the case. Important exhibits should also be presented whenever possible. As a minimum, abridged cases should contain a complete list and brief description of all exhibits referenced in the complete case. If readers are interested in teaching a case published in abridged format, they should request a copy of the complete case directly from the corresponding author.

Examples of complete and abridged cases are published in the Journal of Natural Resources and Life Sciences Education (see pages 9-26). Prospective authors may reference these for guidance on format and style. See a recent issue of the Journal for the “Suggestions for Contributors” page for contribution guidelines and style information (see p. viii).
SUSTAINABLE SYSTEMS FOR THE FUTURE: THE NEBRASKA PROGRAM

Developed by:
Charles Francis, James King, Terry Klopfenstein, James Brandle, Charles Shapiro, Robert Wright, Steve Waller, and Elbert Dickey

Audience: Professionals interested in sustainable agriculture

Objective: To present a short description of one state's efforts in sustainable agriculture

To understand the components of an ongoing education program

Method: Material could be used as a reading, or case study, or individual core components.

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Nebraska straddles the "middle border" between Corn Belt and Great Plains, including rain-fed corn-soybean and sorghum-soybean, dryland wheat-fallow and ecofallow, irrigated corn and alfalfa, river valleys, and cow-calf and yearling grazing in the sandhills region. To sustain this diverse agricultural industry, farmers and ranchers have been seeking economical and resource-efficient strategies to minimize production costs and add value to their feed-grain commodities. Increasingly, the research and educational programs to support these efforts are being identified as sustainable agriculture.

HISTORY – MAJOR ISSUES AND GOALS

Challenges in the Nebraska environment include lack of consistent rainfall in dryland production areas, increasing dependence on and higher costs of imported non-renewable resource based inputs, distance to markets for low-value feed grains, and narrow range of crop and livestock commodities that create a fragile agricultural industry. Narrow economic margins over the past decade have pushed row crop farmers to pursue the only option they perceive as viable: adding more acres to their operations. Heavy reliance on government subsidy programs requiring conservation compliance has improved conservation efforts in the state, but the need to preserve a commodity base acreage has been a disincentive to crop diversification. The separation of livestock from crop production has reduced the potential for using alfalfa and other forages and animal manure on most farms. Increasing farm size has contributed to decline in rural population and the continuous erosion of traditional rural communities, services and infrastructure.

In Nebraska, sustainable agriculture is a philosophy that promotes integrated systems of plant and animal production, using practices with site-specific applications that will help us achieve the following goals:

* satisfy human food and fiber needs
* enhance environmental quality
* maintain and enhance where possible the natural resource base
* make efficient use of both renewable and non-renewable resources
* integrate natural biological cycles and controls
* ensure the short- and long-term profit and viability of farms and ranches
* enhance the quality of life for farmers and ranchers
* promote viable rural communities
Our approach to implementing this philosophy in Nebraska has focused on integration of systems-oriented subject matter and specific activities in existing classes, research projects, and extension programs. There have been seminar series on sustainable agriculture in both animal science and agronomy; a first-year course on agri-ecosystems and a senior course on agroecology and sustainable development have been instituted. While there is a Center for Sustainable Agricultural Systems (CSAS), the major emphasis has been integration of this philosophy into the mainstream of university programs and activities.

**FUNDING SOURCES**

The Center for Sustainable Agricultural Systems has a state funded budget of $105,000 per year. This funds a 0.4 FTE director, 1.0 FTE administrative coordinator, 0.5 FTE secretary, and minimal operating and travel. There are six faculty associates who are appointed by the Vice Chancellor and meet monthly to work with the director to review projects and plan specific activities; they have no FTE appointment or budget allocation. All other activities are financed by grants from the federal government, foundations, or special projects using state funds. To date, these sources have included the Agricultural Research Division (UNL), (USDA SARE Program, ES, CSRS special grants), League of Women Voters, Kellogg Foundation, and Northwest Area Foundation. In the first three years of CSAS operation, these grants total about $300,000/year.

**RESEARCH ACTIVITIES**

A wide number of long-term research projects could be considered a part of the "sustainable agriculture" agenda; among these are breeding for insect and pathogen resistance, irrigation scheduling, shelterbelt research, fine-tuning fertilizer and herbicide rates, rotational grazing, reduced tillage and residue management. For purposes of this report, the research that has been initiated over the past several years that has been closely identified with sustainable agriculture funding is listed. This review is not to be considered complete, but rather a set of projects that provides examples from a more comprehensive research effort by the university. Some of these experiments are on station, and others on farm; in most cases the plot size is large enough to accommodate full-sized field equipment to simulate commercial production practices.

* an integrated farm project at the Agricultural Research and Development Center (ARDC) near Mead has brought livestock and crops research together in composting, grazing crop residues, windbreak effects on horticultural crops (CSRS special grant & state funds)
* grazing corn and grain sorghum stalks in ridge till and conventional flat planting systems (SARE)
* grazing grain sorghum stalks with and without windbreak protection for cattle during winter months (ARD special grant)
* design and testing of alternative riparian strip vegetation plantings for soil conservation and wildlife habitat (state & USFS funds)
agroecosystems (ACE grant)
* survey of impact of sustainable farming practices on biological and economic outcomes on Nebraska farms (CSRS special grant)
* relay cropping and double cropping of winter wheat and soybeans, including different varieties and dates of planting (state funds)
* long-term rotations of corn or sorghum - soybean - corn or sorghum - oat/clover compared to two-year rotations under different input levels (conventional chemical, organic with animals, organic with green manure) (state funds)
* limited irrigation experiments in crop rotational patterns, including discrete treatments and gradient water treatments (special state grants)
* different strip widths and residue management strategies in contour strip intercropping rotations (SARE)
* different nitrogen levels in corn - soybean and sorghum - soybean rotations compared to continuous cereal cropping systems (NE Dept. of Energy)
* starter fertilizer versus none in farmer comparisons over years and locations (state funds)
* rotational grazing management on stations and on farms (state funds)
* windbreak effects on grain production and windbreak economic studies (McIntyre Stennis funds)
* microclimate impacts of shelterbelts in agroforestry systems (CSRS funds)
* impacts of global climate change on the benefit of linear woody corridors (DOE-NIGEC funds)

EXTENSION/OUTREACH ACTIVITIES

The guiding philosophy of our involvement in extension is to integrate programs into the mainstream meetings, tours, and publications with farmers, ranchers and other clients. Specific activities organized by the CSAS include: an annual sustainable agriculture tour (in 1993 this tour focused on alternative crops and value-added enterprises); an Integrated Crop Management in-service training workshop for Extension and SCS personnel from Iowa, Missouri, Kansas and Nebraska; an Integrated Crop Management workshop for a similar audience in California; planning for in-service training of Extension educators under Chapter 3 of the current farm bill, in cooperation with the other 11 states in the North Central Region. The Center for Sustainable Agricultural Systems has recently developed a descriptive folder, "Focus on Sustainable Agriculture" (Appendix 1), to better inform clients about what is available through the University of Nebraska. This was sent to all county offices and to all owners of land in Nebraska through the ASCS; there were 125,000 copies sent out to land owners. Sections in this bulletin are focused on agricultural profitability, crop production, livestock production, and natural and human resources. Highlights include:
Sustaining Agricultural Profitability:

* short-and long-term economic consequences of alternative management practices
* pricing and marketing organic produce, and impact of supply and demand factors
* enterprise budgets for multiple cropping, alternative tillage, and rotation systems
* economic evaluation of alternative policies and regulations affecting sustainable systems
* integrated systems for grazing and animal facility design
* efficiency of irrigation through systems design and scheduling
* impact of alternative cropping systems and pest management on food safety

Sustaining Crop Production:

* testing crop varieties for increased water use efficiency
* soil and crop management practices to reduce erosion and maintain production
* use of native and adapted low resource-use plants
* non-chemical and other IPM methods to reduce pest damage to crops
* demonstration of biologically diverse cropping systems: relay and contour planting
* conservation of pastures, rangelands, riparian strips, and forest lands

Sustaining Livestock Production:

* design of livestock systems and farmsteads for efficient energy use
* optimizing livestock profitability with environmentally sustainable practices
* education in integrated resource management
* efficient use of internal and purchased resources to sustain productivity
* sustainable grazing and finishing systems for beef using resources produced on the farm
* programs on composting, manure handling, application methods that preserve water quality

Sustaining Natural and Human Resources:

* education in integrated resource management
* efficient irrigation and tillage systems for improved water use and reduced pollution
* demonstration of agricultural safety and equipment development for farmers with handicaps
* training about chemical hazards in both production and food systems
* programs on vitality of wildlife populations reflecting diversity in agricultural landscapes
* promotion of trees and shrubs for ecosystem conservation and protection
* aquaculture opportunities for diversification and recycling resources
* programs on the proper management and recycling of solid wastes
EDUCATIONAL ACTIVITIES

With funding from a SARE grant, Jim King and Charles Francis are working with colleagues in the North Central Region to develop a national curriculum in sustainable agriculture. Three workshops have been held to review available educational materials and to present new modules. These will be assembled and made available in hard copy and electronically to interested educators across the country.

There are several specific courses in the current curriculum in Nebraska that relate to sustainable agriculture, and other new courses or revisions in courses that have relevance to this area. In general, the university is lacking in courses with a systems orientation, and that provides impetus for the cooperative regional teaching program that is proposed below. Current or planned courses include:

* First year course on The Agri-ecological Systems (may be required of all first-year agriculture students starting in 1994)
* Natural Resources 100, Introduction to Natural Resources
* Major modifications in introductory crop science course, to be called Crop Production Systems, including topics in agroecology
* Major modifications in advanced crop science course, to include special emphasis on global agricultural systems and resource use efficiency
* Senior seminar in Sustainable Animal Systems
* Undergraduate/graduate seminar in Sustainable Agriculture
* Senior level course in Agroecology and Sustainable Development to be taught for the first time in 1994
* Integrated Resources Management, a senior-level systems class taught in Forestry, Fisheries & Wildlife since 1979

In addition to these courses at the University of Nebraska, there is an initiative being developed through the leadership of the CSAS and grants from SARE, Kellogg Foundation, and Northwest Area Foundation to establish a North Central Institute for Sustainable Systems. This 12-state activity would offer a major in sustainable systems to undergraduates on one of the campuses in the region, using university faculty, farmers and ranchers, and specialists from environmental, non-profit, and business groups. This major would include classroom education in basic sciences and humanities along with a comprehensive hands-on, experiential program in the field. There would be smaller programs offered for majors and minors, as well as internships, on the other campuses. In the future, this institute would also be highly involved in extension in-service training for integrated crop and animal production systems and natural resource management. There will be special courses designed for consultants, input dealers, lenders, land owners, and other appropriate client groups.

A book series, Our Sustainable Future, has been launched by the University of Nebraska Press. Published books include "Ogallala: Water for a Dry Land" (by John Opie) and "Building Soils for Better Crops: Organic Matter Management" (by Fred Magdoff). For this fall, two books will be released: "Agricultural Research
Alternatives" (by William Lockeretz and Mollie Anderson) and "Crop Improvement for Sustainable Agriculture" (by Brett Callaway and Charles Francis). Due to be published in January is "Future Harvest: Pesticide Free Farming" (by Jim Bender). Charles Francis is one of the series editors and provides leadership in identifying authors and topics as well as future directions. The series will include four or five titles per year, and provides a foundation on which educational programs can be built.

PRODUCER-INVOLVED ACTIVITIES

There are several organizations through which the university works to involve farmers and ranchers in research and educational programs throughout the state. Most prominent are the advisory committees that work with each of the district research and extension centers and with the county and extension programming units (EPUs) in planning programs, raising necessary funds and other support, and identifying volunteers. Producers are frequent participants in panel discussions at extension workshops, and often lead field tours of demonstration plots.

The Nebraska Sustainable Agriculture Society was founded in 1977 as an organic agriculture group, and assumed its current name in 1987. This farmer and rancher organization is dedicated to a resource-efficient, profitable, and environmentally sound agriculture and currently has about 250 members. Activities include grant-funded research and demonstrations, tours, and workshops. NSAS publishes brochures, reports, a newsletter, and an up-to-date membership list. Several joint field research programs and educational meetings occur each year with Extension, and joint publications have brought results to a wider audience. The Organic Crop Improvement Association has a small but active membership and some highly successful members in this specialty area. The Center for Rural Affairs (CA) works closely with beginning farmers as well as with national policy issues. Their organizational work has been instrumental in forming legislation for the last two federal farm bills. The CA has been highly involved in the organization and convening of the Sustainable Agriculture Working Group, with activities extending beyond the Midwest to the national level. They have pioneered establishing liaison with environmental groups interested in agriculture. A current joint project with CA and Tim Powell of the UNL Northeast Research and Extension Center involves mentoring and other educational activities with beginning farmers. A major grant proposal to the Kellogg Foundation is being prepared by CA, CSAS, and NSAS.

Some of the commodity boards in Nebraska have organized forums for discussion of the future of agriculture, and the boards support research through the university. The Nebraska Energy Office has provided some funds through grant programs to support demonstrations and on-farm research, as well as educational programs. The Natural Resource Districts have provided some funding for such important projects as demonstration of reduced and appropriate nitrogen fertilization rates, nutrient budgeting, and irrigation scheduling. Many of these projects have been accomplished through the university.
An inventory taken during one year in the late 1980s revealed more than 140 on-farm experiments or demonstrations organized by researchers, extension educators, and farmers throughout the state. These ranged from uniform variety tests to fertilizer rate trials, herbicide testing to comparison of tillage and residue management options, terraces and contour strip intercropping, intensive rotational grazing to use of legumes for soil building. The on-farm dimension of our research and education is a growing component of the total program, and Nebraska has pioneered in development of statistical designs and analyses for generation of credible results and recommendations from the field trials.

Over the past several years, UNL has sponsored several conferences and workshops related to sustainable agriculture. In 1986 UNL, USDA-SCC and USDA-FS co-sponsored the First International Symposium on Windbreak Technology in Lincoln; since then three additional workshops have been held in Harbin, China (1990), Ridgetown, Ontario, Canada (1991), and Viborg, Denmark (1993). In 1988 we organized and sponsored the first North Central Regional Workshop on Sustainable Agriculture, along with an organizational meeting for the program that led to the SARE grants for this region. The Agricultural Research Division has taken leadership for the regional grant program since its inception. UNL received national support to host a National Conference on Sustainable Agriculture and Natural Resources in 1990. CSAS worked with the League of Women Voters in 1991 to sponsor a forum on the future of the agriculture and food industry. In conjunction with the Rural Policy Research Institute, UNL hosted a national symposium on the impact of the 1990 farm bill on land grant universities. In 1992-1993 there was a series of seminars that explored the design for the 1995 farm bill, including sessions on natural resources, cropping systems, animal systems, and human dimensions of federal programs. There are proceedings available from all of these workshops or seminars; contact the CSAS office for order information, 402/472-2056.

FUTURE VISIONS AND PLANS

Short-term plans for the CSAS include a three-year report on activities of the Center, prepared in anticipation of the review that will determine whether the program is renewed for another five years. A series of end-user workshops on integrated crop management is planned for September 1993, to include farmers, crop consultants, input dealers, Extension educators, and others in agriculture. An interdisciplinary seminar series for the 1993-94 academic year will focus on "Designing a Sustainable Future," and include topics on systems design, crop systems, animal systems, integrated pest management, natural resources and landscape design, alternative economic models, policy impacts on sustainable agriculture, and designing diversity into a sustainable future.

Future research plans include expansion of the integrated farm project at ARDC to include more investigators from other departments in the Institute of Agriculture and Natural Resources. More work on composting, alternative fertility sources, non-animal organic crop management, horticultural crops, diverse field system design, wetlands treatment of animal waste, and riparian zone management will receive increased emphasis. Grants are being prepared in several of these areas. Integrated crop/animal
management systems research at four other research and extension centers are being planned. A new on-farm research and demonstration project in cooperation with NSASD and CA is seeking support through the Kellogg Foundation's Integrated Farming Systems Initiative. We are also submitting a proposal to design and manage the evaluation component of that same program.

ORGANIZATIONS IN NEBRASKA

In addition to the University of Nebraska, a number of other private and public groups are involved in one way or another in sustainable agriculture activities. Several have been mentioned above. Here is a brief list with their relevant activities:

* Nebraska Sustainable Agriculture Society: membership-based farmer organization, newsletter, local chapters, on-farm research, tours and workshops.
* Center for Rural Affairs: policy research and advocacy, beginning farmer program, Land-Link Realty Co., workshops, leadership in Sustainable Agriculture Working Group.
* Nebraska Department of Agriculture: promotion of alternative crops and enterprises, marketing alternatives.
* Nebraska Energy Office: on-farm research and demonstrations of resource efficient practices.
* Natural Resource Districts: watershed based groups that set regulations for water quality, nitrogen management, water use, educational programs, demonstrations, cooperative tours.
* Commodity Boards: finance research projects, convene workshops.
* League of Rural Voters: advocacy for rural Nebraska, small community issues.
* Center for Semiarid Agroforestry, USDA Forest Service, Rocky Mountain Forest & Range Experiment Station, Lincoln: the mission of CSA is to advance the development, application, integration, and acceptance of agroforestry practices in sustainable land use systems for production, resource conservation, and human environments.

NOTES

1Paper presented at the North Central Region Sustainable Agriculture Workshop. Presentation in Wooster, Ohio, August 16, 1993

2Presentation from the Center for Sustainable Agricultural Systems, Institute of Agriculture and Natural Resources, University of Nebraska-Lincoln, Lincoln, NE 68583-0915

3Center for Sustainable Agricultural Systems, Departments of Information and Computer Services, Animal Science, Forestry Fisheries and Wildlife, Agronomy, Northeast and South Central Research and Extension Centers, Agricultural Research Division, College of Agricultural Sciences and Natural Resources, and Cooperative Extension Division, University of Nebraska
RELEVANT PUBLICATIONS


Resource Efficient Farming in Nebraska. A. Franzluebbers and D. Dittman, editors. Cooperative Extension, IANR and Nebraska Sustainable Agriculture Society. 121 pp. (1990)


The Future of Agricultural Research and Extension: Policy Perspectives. J. Scott and P. Murray, editors. RUPRI Report, Center for Sustainable Agricultural Systems and Department of Agricultural Economics, University of Nebraska. 36 pp. (1993)

An Integrated Crop/Livestock Farm for Eastern Nebraska. G. Lesoing and T. Klopfenstein. Systems Paper No. 93-1, Center for Sustainable Agricultural Systems, University of Nebraska. 8 pp. (July, 1993)
INTEGRATION OF ENVIRONMENTAL & SUSTAINABLE DEVELOPMENT IN EXTENSION: CASE STUDY FROM NEBRASKA, USA

Developed by:
Charles A. Francis

Audience: Professional and students interested in sustainable agriculture

Objective: To describe in detail one state's efforts to integrate environmental and sustainable development in extension programming

Method: Material could be presented as part of a case discussion on extension programs
INTEGRATION OF ENVIRONMENTAL & SUSTAINABLE DEVELOPMENT IN EXTENSION: CASE STUDY FROM NEBRASKA, USA

Charles A. Francis, Extension Crops Specialist, University of Nebraska
Professor and Director, Center for Sustainable Agricultural Systems

EXECUTIVE SUMMARY

Environmental issues are becoming more evident in the planning of extension and other educational programs in agriculture. Although limited in number, several important programs are under way in the Cooperative Extension Division of the Institute of Agriculture and Natural Resources, University of Nebraska -- Lincoln. Published progress reports, staff activities reports, and personal interviews with administrators, specialists and extension agents were used to assess the current state of integration of environmental information and messages into the overall extension program of the state.

Nebraska (USA) has about 18 million ha in farms, with 9 million ha in cropland and 8 million ha in permanent pasture and range; about 3.3 million ha is irrigated. Predominant systems include continuous maize under irrigation, maize--soybean and sorghum--soybean, and wheat--fallow rotations. Elevation is from 300 to 1500 m above sea level, and rainfall plus snowfall totals 400 to 750 mm of annual precipitation. Windborne silt, sandy soils, and silt-loams predominate in Nebraska. The most challenging environmental issues are shortage of water (rainfall or irrigation) and non-point source pollution of rivers and aquifers by nitrate and pesticides. There are about 56,000 farms with over $1000 in annual sales, and a farm population of 225,000. Approximately 4% of farms are women-headed households, and about 25% of total agricultural labor force is female. The extension faculty is 36% female.

National and local policies are playing an increasingly important role in agricultural decision making. Laws and policies relate to water and air quality, soil erosion, water available for irrigation, control of pesticide application, planting of windbreaks and care of wetlands, preserving endangered species, and investment in agriculture. Local rules in some areas govern timing and rate of N application, well density, and conservation planning. The Conservation Reserve Program (CRP) currently includes 550,000 ha in Nebraska, and soil loss has been reduced from 60 tons/ha/yr to less than 4 tons/ha/yr, or a total soil loss prevention of more than 30 million tons/yr. The Environmental Protection Agency and the Agricultural Stabilization and Conservation Service are the primary federal agencies in charge of environmental regulations, while some local rules are set by farmer-controlled Natural Resource Districts that are organized by watershed in Nebraska. The role of Cooperative Extension is to develop educational programs that will help farmers comply with the federal, state, and local regulations.

Nebraska Cooperative Extension has 330 full time faculty positions located around the state; they reach about 400,000 people per year with direct educational contacts, and about 88,000 youth in various development programs. Specific programs include certified pesticide application training, integrated pest management training, family community leadership, food
processing consulting, field days on water and environment, expanded food/nutrition, and small scale entrepreneurship training. Four of the current six priority initiatives relate to environmental issues: agricultural sustainability, water quality, waste management, and enhancing communities. The current annual budget is $27,600,000, with 51% from state, 23% from county, 20% from federal, and 6% from non-tax funds.

The mandate for Extension to integrate environmental education comes primarily from within the university community, although there is substantial pressure from conservation groups to increase the emphasis on environmental and natural resource issues. Educational messages and programs reach people in Nebraska through the mass media (press, radio, TV, magazines), special topic meetings, and regular workshops during the winter months. Specific activities dealing with environmental topics include scouting for weed and insect problems to reduce pesticide applications, irrigation scheduling to reduce water use, conservation tillage practices to reduce erosion, demonstrations of drought tolerant crops and varieties, composting and solid waste management workshops, controlled grazing management systems, and best management practices for crop production and profitability. There is a close linkage between research and extension on these topics because most of the state and district level extension specialists have a split appointment in both areas. Some of the specific publications that reflect a concern for environmental issues include:

- Managing for residue-free products
- Laundering contaminated clothing
- Conservation production systems
- Composting municipal sludge slurry
- Windbreak maintenance & renovation
- Disease prevention in feedlots
- Conservation of highly erodible lands
- Emergency wind erosion control
- Natural air corn drying
- Buffalograss: energy efficient turfgrass

Both farmers and extension personnel are concerned about including more environmentally-oriented information in programming in the future. At present, there is more environmental content in materials that are developed for elementary school programs than for mainstream adult extension programs. Messages for adults relate more to specific decisions and regulations in farming, in municipal water supplies, in management of solid waste, and in meeting federal and local regulation requirements. The most frequent messages relate to water and air quality, and to management of the scarce water resource. There is growing concern about exposure to pesticides during transport, mixing, and application, as well as to residues in food products. Conventional wisdom in the U.S. is that we have a very safe food supply, but publicity surrounding health risks of chemical residues causes great concern; it is difficult for the general public to evaluate relative risks.

The Extension program of University of Nebraska is enhanced by the Center for Sustainable Agricultural Systems, a coordinating group that promotes education around environmental and resource-related issues. The Center has sponsored a national conference, a number of regional and statewide activities, district workshops, and on-farm research projects that promote efficient resource use and environmentally sound practices. In conclusion, there are few programs in Nebraska that are entirely focused on environmental issues and sustainable development, but there is a growing level of concern and rapid development of materials related to this important area of emphasis.
INTEGRATION OF ENVIRONMENTAL & SUSTAINABLE DEVELOPMENT IN EXTENSION: CASE STUDY FROM NEBRASKA, USA

Charles A. Francis, Extension Crops Specialist, University of Nebraska
Professor and Director, Center for Sustainable Agricultural Systems

I. Environmental Issues in Nebraska: An Introduction

Nebraska (USA) has land in both the midwestern rainfed corn belt and the arid great plains, plus irrigated river valleys. Over the past two decades, environmental issues have become critical in the planning of informational programs in agricultural extension. An emerging focus on sustainable development has captured the interest of some clients, administrators, and specialists, although not often identified with that term. This case study summarizes the programs currently under way in the Cooperative Extension Division (CED) of the Institute for Agriculture and Natural Resources, University of Nebraska, as well as related efforts by other organizations in the state. In order to provide a broader appreciation of new extension initiatives in this region and a window on the diversity of approaches being taken, some examples are brought in from nearby states to illustrate the potentials for future programs. In fact, the future will see more cooperative programs across state lines as budgets become more limited and there is need to share expertise within the total extension faculty.

The sources of information for this report are published summaries of extension programs in Nebraska and nearby states, reports on staff activities as assembled by the office of the Director of Extension and personal interviews with key administrators and specialists in the Cooperative Extension Division.

This report includes (1) a brief description of agriculture in Nebraska and the natural environment in which it operates; (2) current roles and programs of the CED as well as related programs in the private and public sectors; (3) examples of the environmental issues and
messages; (4) extent of integration of environmental elements into mainstream programs; (5) description of the process of how environmental issues have been integrated; and (6) a summary of the lessons learned from this experience.

II. **Context: Agriculture, Policies and Institutions in Nebraska**

"Nebraska Territory -- the vast, nearly treeless expanse of grass was all that welcomed the first pioneers who traveled west for new land. Those first settlers came to the 'Great American Desert' to carve up a new way of life, just as their plows carved up the thick sod for their shelter and crops. Even the greatest thinker among them could not have predicted the wealth and fertility of the soil they turned. What was virgin prairie 100 years ago is now considered one of our nation's most valuable resources and is the foundation of Nebraska's primary industry, agriculture." (Nebraska Agriculture, 1985)

A. **Agricultural Sector**: The state of Nebraska has about 18 million ha in farms, of which 9 million ha is cropland, 8 million ha is permanent pasture and range, and less than 1 million is in woodlands, farmsteads, ponds, roads and wastelands. Of the total, about 3.3 million ha is irrigated from either surface or underground sources. Predominant systems are continuous corn under irrigation, corn--soybean and grain sorghum--soybean rotations, and wheat--fallow rotations. Other crops of lesser importance in these rotations include oats, barley, rye, dry beans, sugar beets, potatoes and vegetable crops.

B. **Natural Environment**: Rainfall and length of growing season are the primary determinants of crop choice and cropping system in Nebraska. The Southeastern Region has about 750 mm annual precipitation (rain + snow) and a minimum elevation of 300 m, while the Western Region has precipitation below 400 mm and elevations above 1500 m. Loess soils (windborne silt) cover the Eastern part of the state, sandy soil covers a large area of the North Central "Sandhills Region" and silt loams predominate in the rest of the state. The immense Ogallala Aquifer underlies about one-third of the state, and stretches to the south as far as Texas, while rivers, streams and waterways provide surface irrigation potential in many valleys.
There is a large natural population of white-tailed deer, perhaps greater than before the introduction of farming, due to absence of predators. Many other native mammals thrive in the river valleys, grasslands and woodlands. Migrating American bison herds have disappeared. The Platte River and nearby wetlands are host to millions of migrating birds twice each year, as they move from the tropics to northern latitudes and return. There is some native fish population in rivers, lakes and reservoirs. The two greatest environmental problems are shortage of water due to multiple demands on the rivers and non-point source pollution of rivers and aquifers by nitrate and pesticides.

C. **Agricultural Population:** Number of farms in Nebraska has declined from 129,000 in 1925 to 56,000 in 1992; a farm is defined as having at least $1,000 in annual sales. Average farm size has increased from 160 ha to 340 ha over this same period. The total farm population is estimated at 225,000 out of a total state population of 1,600,000, or about 14%; many people in the farm population are employed elsewhere, though often in an agriculturally related industry. Half of the farm operators report some off-farm employment, and one-fourth report working at least 200 days/year off the farm. About 4% of farms are women headed households, and about 25% of the total agricultural labor force is female, including all production-related activities such as record keeping and financial management. There is a large on-farm employment of youth in agriculture, estimated at 50,000 people; most are part-time. There are currently about 6,000 students studying agriculture in the 127 secondary schools that include these programs in the state, and 88,000 young people involved in 4-H programs. There are agricultural courses in ten state colleges, community colleges, and the School of Technical Agriculture in Curtis.

D. **National and Local Policies:** Regulations and policies related to agriculture and the natural environment are a growing force in the practices and design of systems in Nebraska.
There are a number of national (USA) laws and policies as well as local agreements or rules established by states, communities, or natural resource districts that are related to the environment (Olson, 1992). Those related to agriculture focus primarily on water quality, soil erosion, quantity of water available for irrigation, location and type of pesticide application, planting of windbreaks, maintaining wetland habitat, preserving endangered species and defining investment in agriculture. Rules are far too extensive to enumerate, but examples can suffice to illustrate the current regulatory climate. National regulations do not permit communities to have a water supply with greater than 10 ppm nitrate; most of the problem in rural areas can be traced to point source confined livestock operations or to non-point pollution from excessive nitrogen fertilizer use.

Local rules have been invoked in Nebraska in some Natural Resource Districts (NRDs) to limit amount of N applied to crops. They have also regulated the well density per unit land area and permits must be secured before putting down a new irrigation well. Currently farmers are required to have a conservation plan prepared and fully in place by 1995 in order to participate in government commodity price support programs. Pesticide applications of restricted materials can only be made by farmers or commercial firms if they have successfully completed a pesticide safety training course and received an official certification. These rules have been introduced over the past several decades, and are directed at both farmers and input dealers/applicators in the rural sector. For example, new rules in 1993 do not allow application of certain herbicides within 20 m of streams or lakes. The Environmental Protection Agency (EPA) is charged with enforcement of the rules. The CED is in charge of the pesticide safety training courses, but the testing is done by the EPA.

One major program affecting wide areas in Nebraska is the Conservation Reserve Program (CRP). There are currently about 14 million hectares in this program nationwide, for
which farmers are paid an average of about $120 per hectare per year. Estimated soil loss from these fields before the program was 50 tons/ha/yr, and this has been reduced to less than 4 tons/ha/yr; total soil saved per year as a result of the program is estimated at 655 million tons/yr. In Nebraska, there are 550,000 ha in the program, including 1190 ha in trees and 137 ha in filter strips. Estimated soil loss before the program was 60 tons/ha/yr and with the program about 4 tons/ha/yr; total soil erosion loss prevented by the program in Nebraska is estimated at 30,234,000 tons/yr. There is hope that some of these programs will continue past 1995-97 when the first fields are scheduled to come out of the plan.

E. National and Local Agencies and Organizations: The EPA is the primary federal organization charged with elaboration and enforcement of regulations related to the environment. The Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) is the legislation that regulates all pesticide use. The EPA must evaluate both the risks and benefits of using each chemical, including the ecological risks. As noted above, they set the rules on pesticide use -- including approval of each product in terms of crops to which it can be applied, protective measures including clothing, gloves, or mask suggested for people working with the product (both in manufacture and use), re-entry time before people can enter a field or a crop can be harvested, and other details that appear on the legal label for each product. The products must be clearly labeled, and cannot be sold or transported in any container that does not bear the label. Biological toxicity tests of any new products are stringent, licensing is expensive and the standards are set and approval of products given only by the EPA. There is an on-going problem of export of chemical products that are not allowed for use or are severely restricted in the USA, but were not regulated by importing countries. The laws regarding exports have been tightened and this problem is being solved.

Other significant programs of the EPA related to agriculture include nonpoint source
management of pollution, wellhead protection for public drinking water supply, wetlands
management, regulation of genetically engineered organisms, and livestock waste management
(Robarge and Benforado, 1992). State plans for control of nonpoint source pollution must be
approved by EPA; this is important because agriculture is a major source of such pollution in
over 50% of the river miles in the USA that are so affected. The areas around wellheads must
be protected from chemical contaminants, including those from agriculture. In Nebraska, there
are devices that can apply fertilizers or pesticides through an irrigation system and there are
double check valves at the source of chemical to prevent back-siphoning of product into the
aquifer; these must be checked and certified each three years. Agriculture has been responsible
for nearly 90% of the loss of wetland habitat, but this is now carefully controlled. Livestock
waste can be a point source of pollution, and EPA rules regulate storage facilities and type of
discharge from storage.

Rules relating to conservation provisions of the federal farm bill are established by the
Agricultural Stabilization and Conservation Service (ASCS). In coordination with the Soil
Conservation Service (SCS) and CED, the agencies that help in educational programs and
demonstrations, the ASCS approves conservation plans with farmers that specifies for each field
and farm the type of residue management, tillage practices, terracing and other agronomic
procedures permitted that will reduce potential soil erosion from the field to the "T-value", that
amount that will be replaced by natural weathering of parent materials and soil regeneration.
Farmers sign an agreement to comply with these regulations and further agree to repay any
government benefits if they do not successfully implement the farm plan. The Conservation
Reserve Program (CRP) is designed to take out of production the most highly erodible lands.
Farmers are paid to plant soil-conserving species on these fields for a period of ten years, with
strict regulation of when the land can be grazed. There is great concern about the fate of these
fields when the first phase of the program reaches its conclusion in 1995-1997. These are examples of programs designed to reduce negative environmental impacts from agriculture.

The role of CED is entirely educational in these government programs. Through written materials, meetings, field tours, special workshops, extension specialists provide interpretation of regulations and applications of practices and systems design to help farmers and ranchers build their information base to comply with the law. Extension and research specialists in the university also provide technical results and recommendations that become part of the SCS and ASCS guidelines for farmer compliance with regulations. Joint inservice training sessions for SCS and Extension specialists are part of the comprehensive educational programs conducted by Extension.

F. Status of Extension Service: The CED of the Institute of Agriculture and Natural Resources, University of Nebraska, is representative of the state-based extension efforts in the USA. These are called "cooperative" because of the joint funding of projects by federal, state and local resources. At a typical county office, the technical personnel may be paid from all three sources; local office expenses and vehicle may be paid by the county extension board. Further details are (University of Nebraska, Cooperative Extension, 1993):

1. Cooperative Extension was founded with the federal act of 1914.

2. Nebraska currently has 330 full time equivalent faculty positions, of which 70 are located at the University campus in Lincoln, 42 at the five district research/extension centers, 143 at county or multi-county offices, and 76 are Extension Assistants. Many faculty have joint appointments in research or teaching. The faculty is approximately 64% male and 36% female.

3. Programs in Extension reach about 400,000 people each year with direct educational contacts; youth development programs reach about 88,000 young people, or one-third of youth in Nebraska between 9 and 19 years of age. In 1992, about 18,000 4-H volunteers and 17,000 Home Extension Club volunteers contributed time and resources to the state's programs. The following programs and numbers of clients were among the activities recorded last year, in addition to the frequent tours, training sessions, informational meetings and individual consulting with farmers and ranchers:
• certified pesticide training for 18,700 applicators
• integrated pest management training for 1300 farmers
• family community leadership certified 350 people
• food processing consultants for 100 businesses
• field days on water/environment for 7,000 students
• Backyard Farmer TV program has 77,000 viewers/week
• expanded food/nutrition program for 1200 low-income families
• small-scale entrepreneurship program for 660 people

The six current priority initiatives that complement the on-going core extension program include four(*) that are directly related to the environment and sustainable development:

• agricultural profitability and sustainability*
• children, youth, and families at risk
• enhancing water quality*
• food safety and quality
• strengthening communities*
• waste management*

4. The annual budget for Nebraska CED in the current fiscal year is about $27,600,000; 51% is from state funds, 23% from county funds, 20% from federal funds and 6% from non-tax funds.

III. Current Roles and Activities of Cooperative Extension

A. "The mission of the University of Nebraska Cooperative Extension is to help Nebraskans address issues and needs related to their economic, social and environmental well-being through educational programs based upon scientific knowledge" (Univ. Nebraska, 1993). This mission must operate within the broader goals of the university to be "the premier provider of research-based information and educational opportunities within Nebraska." Chancellor Graham Spanier has insisted that the University of Nebraska will be a positive force in the state for social change. Within this mandate, the university is increasingly focused on programs and educational activities related to environmental issues; the concept of sustainable development is slowly emerging as a unifying ideal that will shape programs of the university and other agencies as well as non-governmental organizations in the future. As yet, this term is not widely understood or used.
The actual mandate for Extension to integrate environmental education into programs comes primarily from within the university community, through a realization of the importance of this direction and the long-term needs and well-being of clients. Another mandate is given to Extension from the state of Nebraska through annual appropriations and the legislative hearings that lead up to a budget decision each year. There is pressure from some organizations (e.g., Audubon Society, Sierra Club, other environmental groups) to place more emphasis on environmental topics in educational programs. At the same time, farmers and ranchers appreciate the need to conserve and wisely use resources in their agricultural pursuits; in fact rural families live closest to such problems as water contamination, drift from pesticides and other on- and off-farm impacts of improper use of inputs. Some in the industry oppose strong involvement of the university in environmental issues, especially when this is viewed as an implementation of restrictive federal regulations or an unwanted control over agriculture. In general, the current climate is highly favorable to include environmental dimensions in many extension programs.

B. Roles and Activities of Cooperative Extension, as described above, are to bring relevant, timely, and objective information to people of Nebraska through educational materials and programs, in order to foster agricultural and business productivity, enhance families and communities, and improve quality of life. Extension operates throughout the state, with offices or a presence in each of 93 counties that are grouped into 21 extension programming units (EPUs). Within each of these EPUs, there are designated staff with responsibilities toward such environmentally important issues as waste management, water quality, and sustainable agriculture.

1. Mass media is frequently used for press releases, short radio and TV spots featuring specialists from the university and farm magazines that regularly include copy from extension programs; Nebraska Farmer is a monthly publication that includes regular
columns and special articles from research and extension specialists. Special topic extension meetings are held around the year. Examples of strong environmental messages include scouting for insect and weed problems to reduce or eliminate chemical applications and irrigation scheduling to reduce costs and non-essential application of the scarce water resource. Summer tours featuring key experiments on stations and conservation-related practices on farms are common activities. Specialists and agents are available for consultation by phone, and frequently visit farmers' fields to help diagnose problems and suggest alternatives.

2. There have been few programs directed only at environmental issues, but this topic frequently comes up in meetings on farming practices. A meeting on profitable farming techniques will include ways to reduce tillage, use moderate levels of fertilizer, reduce or eliminate pesticide applications in favor of other more environmentally benign methods, or substitute other crops that are more tolerant to drought or other stress conditions.

3. There is no legal monitoring role for Extension of practices or environmental regulations, although specialists in the field frequently have a good idea of the level of compliance because of their many visits to farms and observation of many fields in their districts. These specialists work closely with SCS, ASCS and other agencies to keep track of compliance with regulations and how educational programs could be enhanced.

C. **Linkages and Coordination with Other Agencies** begin with the close collaboration with an Extension Board of Directors, local school districts, other federal agencies such as SCS, ASCS and NRDs. Wherever appropriate, joint programming is carried out in cooperation with these agencies. A close working relationship with the research faculty of the USDA is accomplished through joint experiments, co-advising students and shared programs such as the Management Systems Experimental Area (MSEA) that is federally funded and jointly staffed. In Nebraska, the USDA research staff is housed in departments at the university; they enjoy faculty status and function as full members of the research/extension team. A number of curricular materials for agriculture, home economics and science are provided through Extension for classroom use (e.g., "Ag in the Classroom"). 4-H programs are conducted through a large network of volunteers and these often use school and community facilities. County Fairs and the State Fair are conducted by boards in each county, but Extension is in charge of the 4-H programs, the registration and conduct of exhibits and contests and many of the other
programs that take place. Extension provides many of the educational programs for NRDs, for federal agencies that deal with farmers and families and for many private groups such as service organizations, community governments, church groups and private companies. Increasingly, these programs relate to regulations on input use and environmental impacts of agriculture, and the alternative practices or systems that can help solve those problems. Extension also works to promote the economic and environmental viability of communities throughout the state.

Liaison of Extension with other agencies works at the state, the district, and the community level where much local programming takes place.

D. **Sources of Information and Materials** include research from the university and from neighboring states, successful practices from farmers and information from government agencies and the private sector. With most agricultural faculty of UNL carrying joint research/extension or research/teaching appointments, there is a well established linkage between these activities within the organization. Emphasis on environmental dimensions of the research and extension programs has grown rapidly over the past decade. While much of the long-term research agenda has focused on specific practices designed to save soil and increase profitability, many of the same technologies are equally important to reduce environmental damage or to enhance the health of farm families. Target audiences include farmers, ranchers and rural families; crop advisors and input suppliers; technical representatives and dealers in the ag chemical and fertilizer industry; absentee land owners; rural banks and credit organizations; and youth in rural communities. There is a growing program for non-rural people through 4-H, urban gardening and forestry programs, turfgrass research and education, home economics and management, and family issues. Some specific examples of research projects that have provided results for extension programs include:
breeding insect tolerant maize and sorghum hybrids allow these crops to be grown without application of insecticide, reducing potential for residues in the environment or damage to health of the farm population.

new systems of reduced tillage and better residue management on the soil surface can drastically reduce water and soil loss from fields during major rainfall events, preserving water and nutrients for crop development and reducing contamination of waterways.

studies of low cost sources of food and rapid methods of preparation to help two working parent families efficiently provide adequate nutrition for children.

research on families in crisis, in rural and urban settings, that lead to counseling in conflict management, financial management, interpersonal relations, and other family needs.

E. **Target Groups for Extension Programs** have traditionally been the farmers and ranchers who are concerned about more productive or lower cost practices (new varieties, proper fertilizer rates, herbicide mixes), families interested in practical and efficient food, clothing, and home management, and rural youth involved in crop and livestock educational programs through 4-H. Today the audience is widely expanded to include both rural and urban people concerned with food, fiber, fuel, health and quality of life. It is difficult to quantify the audience or the impact of environmentally-related programs. It is possible to enumerate using examples of the types of publications that are currently being developed and used in Extension:

- Managing of disease for antibiotic/residue free products (G883)
- Management for disease prevention in feedlots (G878)
- Effective parenting for greater family well-being (LH11)
- Laundering pesticide contaminated clothing (G943)
- Conservation of highly erodible lands (G909)
- Conservation production systems for row crops (EC714)
- Emergency wind erosion control (G282)
- Wood stove installation safety (HEG170)
- Composting municipal sewage sludge slurry (G464)
- Natural air corn drying (G760)
- Windbreak maintenance and renovation (G923)
- Organic gardening in the backyard (G548)
- Buffalograss: energy efficient turf for lawns (G564)

These publications form the basis for client-oriented programs where energy efficiency, environmental impact and farm safety are discussed along with ways to farm and to manage the home in an ecologically sound manner. Although there has been a move toward greater
environmental awareness over the past decade, there is still a need to increase the educational efforts in this direction.

F. **Role Situation, Problems, Constraints and Prospects** of strengthening the environmental content and potential impact of educational programs are difficult to assess; personal opinions can be supplemented with opinions of specialists and extension agents as well as clients that were gleaned from recent surveys conducted by extension. In a survey conducted in 1992, 90% of extension personnel agreed that the recently introduced issue-based approach, including environmentally oriented activities, is an effective way to develop new programs (University of Nebraska, 1992). It appears that an effective structure for change is in place.

In another survey, Nebraska farmers were asked their opinions about two key environmental issues: soil erosion and water quality (Rockwell et al., 1991). Among the 500 farmers who responded to the survey,

- two-thirds agreed that net return could be increased by reducing inputs, but that this would require more management; awareness and acceptance of alternatives was greatest among young farmers and those with college degrees.
- two-thirds agreed that regular soil testing and careful adjustment of fertilizer rates could reduce groundwater contamination; 58% thought that reducing amount of pesticide could provide similar benefits.
- to fine-tune fertilizer needs, 82% of irrigators used soil tests to determine rates; 69% set yield goals and do nutrient budgets; and 79% of livestock producers apply manure to crop lands.
- almost half of the farmers reported changing to band application and thus lower rates of herbicide; 92% use scouting of insects to determine rates and products, and 20% have reduced their applications as a result of gathering more information on alternatives.
- with respect to structure of farming, over 90% believed that family farmers have greater concern for stewardship than corporate owners, and saw the family farm as valuable to the future of agriculture; 60% thought producing organic foods will be profitable in the future, but most thought federal farm programs currently prevented them from diversification.

With this apparent environmental concern and willingness to consider some changes in farming practices and systems, there is a fertile climate for new educational programs. Major problems associated with this change include negative reactions to government regulations, tight
profit margins that allow little room for risk taking and innovation, latent conservatism within
the agricultural sector, peer pressure within the farm community, and inertia and apathy about
modifying production methods that are currently in place. Much of this analysis is at variance
with the observation that many farmers and ranchers are innovative and multi-talented
individuals who are highly capable of inventing new equipment and putting resources and ideas
together to create new and efficient practices. It is perhaps one of extension's roles to identify
and reward those innovators and to given them encouragement to counsel neighbors and
visitors about environmentally sound practices. Farmer panels are one of the most popular
activities during extension meetings, and this would be one route to tapping into this human
resource.

Programs in neighboring states are highly variable in their environmental content and
focus on sustainable agriculture. Iowa has a highly developed Leopold Center for Sustainable
Agriculture that includes several issue teams in research, competitive grants and an educational
program in collaboration with the practical farmers of Iowa. In other states, the leadership
aims primarily from farmer-based organizations such as the Kansas Rural Center. There is
growing concern about environmental issues across the midwest and this will be reflected in
future programs (see Appendix A).

IV. Environmental Content and Messages

There is growing environmental content in extension educational programs, although the
nature of the messages varies widely across age groups. In general, topics and modules
developed for elementary students stress the elements of the natural environment, their
connectedness, and their importance to habitat for many species and for human quality of life.
For adult audiences, the messages relate more to specific decisions and regulations in farming
systems, in municipal water supplies, and in management of solid waste, for example. A
summary of the content of some representative programs is presented, along with some examples of materials and how they are developed.

A. **Extension Messages with Environment and Natural Resources Content** have become more prevalent over the past two decades as awareness has grown on the impacts of human activities on air and water quality and natural resource depletion. Part of the impetus for this change has been research on the effects of water quality on human health, part on growing concern about direct exposure to pesticides. Water is the most limiting production factor in Nebraska, and long-term studies that show some depletion of the extensive Ogallala aquifer have created new awareness of the finiteness of this crucial resource. It is difficult to enumerate the precise number of meetings, bulletins, radio or TV programs have dealt with each of the practices or topics, since many issues are included in a single event and since many of the practices are related. Estimates of numbers of people reached by each program are taken from a summary of specialist and agent reports of contacts for the most recent year, and the number of meetings that deal with each of the subject matter topics (Stahlecker, 1993).

Reports from the last fiscal year include 357 people who conducted 28,100 meetings; made 6,700 radio and 1,100 TV programs; and prepared 4,800 newsletters and 10,700 popular articles for publication. They had a total of 1,300,000 contacts with clients, of which 45% were with women and 55% with men. Subject matter content of extension messages on resources and the environment can be illustrated with a number of examples (numbers include extension meetings and tours and both classroom and 4-H participation by youth):

1. programs that modify weather impacts at the field level include: a) planting of field windbreaks to reduce transpiration from crops and wind-induced soil erosion; b) use of filter strips along riparian zones to minimize impact of heavy rains; and 3) varied time of planting and different cultivar maturities to avoid major stress events during the cropping season (estimated 2,500 men, 200 women, 800 youth).
2. Programs that protect soil erosion through alternative technologies include: a) building of several types of terraces to prevent soil erosion on highly erodible lands, b) maintaining residue on the soil surface through minimum or zero tillage planting methods, c) contour planting rather than straight planting with field boundaries, d) use of strip intercropping with different crops and filter strips to capture soil runoff, and e) reduced water application rates to minimize potential for soil loss on hillsides (estimated 12,000 men, 500 women, 6000 youth).

3. Programs that enhance the quality and quantity of domestic and irrigation water supply include: a) water testing service of university laboratory and interpretation of results for clients, b) recommendation of remedial devices for improving domestic home or livestock water supply, c) irrigation scheduling to reduce unneeded applications, water and energy costs, d) alternative irrigation methods such as low pressure systems and drop nozzles and e) surge irrigation in gated pipe systems to reduce application rates (estimated 5,500 men, 200 women, 4,000 youth).

4. Programs that promote ecologically sound cropping and crop/animal systems include: a) rotations of cereals with legumes (e.g. grain sorghum--soybean) and summer with winter crops (e.g. maize--wheat--soybean) to reduce pest populations, b) combining surface residue management with zero till planting to increase water capture and storage and minimize soil loss, c) design spatially diverse cropping patterns such as strip intercropping to enhance yield-promoting border effects and increase habitat for predators, d) design feedlots that allow efficient collection of manure and its composting or spreading on cropland and e) grazing crop residues with livestock (estimated 16,000 men, 3,200 women, 2,000 youth).

5. Programs that educate people on reduced input use and safe application of fertilizers and pesticides include: a) crop scouting for insect and weed incidence that uses threshold levels for pesticide application, b) chlorophyll meter readings of maize leaf tissue to test nitrogen sufficiency, c) late spring soil tests that allow lower fertilizer N application rates, d) substitution of management (crop rotations) and renewable resources (clover or manure) for fossil fuel based resources and e) training on safe use of pesticides (estimated 35,000 men, 6,000 women, 8,000 youth).

6. Programs that motivate communities and organizations to improve local facilities and infrastructure include: a) managing main street -- promotion of economically and environmentally sound small businesses in communities, b) promotion of stress tolerant alternative crops that require fewer inputs and elaborated products from those crops in rural communities and c) organizing communities to develop local parks, lakes, recreational areas (estimated 5,000 men, 6,000 women, 4,000 youth).

7. Programs that promote the efficient handling of solid waste include: a) organization of composting of organic yard waste for use in public lands or distribution to farmers, b) meetings to promote recycling and reuse of non-organic materials, and c) inter-community facilities to meet new federal guidelines for solid waste management (estimated 8,000 men, 9,000 women, 2,000 youth).
8. programs that develop understanding of broad environmental issues such as global warming, loss of rainforest, modification of the ozone layer, loss of endangered species, or pollution of oceans are primarily confined to elementary programs, secondary schools and college level instruction; although these topics may be included in presentations to farmers and other adult clients, they would rarely be found as the central issue for a meeting or other educational activity (estimated 10,000 youth).

9. general youth programs that deal with natural resources and environment, including water and nutrient cycles, recycling, natural resource awareness, environmental education (350,000 youth, essentially all school age children in elementary, secondary and introductory college courses).

10. programs developed and circulated by the Nebraska Educational TV Network located on the University of Nebraska-Lincoln campus; numbers of viewers in classroom and in Nebraska have not been estimated. Examples of topics in the environmental arena include (NETCHE, 1992):

- Applications of Solar Energy
- Dawn of the Solar Age
- Ecology: Our Road to Survival
- E. F. Schumacher: Economist
- Pesticides and the Environment
- Planet Earth
- Prairie: Our Natural Heritage
- Race to Save the Planet
- Who's Minding the Farm
- Wind Energy
- World Population Problems

B. Extension Materials Used by Specialists and Agents are many and varied for use with different age groups and in different settings for education. They include NebGuides, Extension Circulars, Bulletins, Videos, Slide Sets, Proceedings and TV Programs. A number of guides for distribution that relate to environmental issues were listed above in section III.E. These are produced in small numbers when there is wide viewing (e.g., TV Programs or Slide Sets) or in large numbers when there is a mailing to an extensive audience (e.g., Focus on Sustainable Agriculture, a brochure sent to all Nebraska land owners whether they live in state or not, 125,000 copies). Most NebGuides are produced in numbers between 5,000 and 15,000; these are used for about five to eight years before they are revised or dropped from distribution.
Some of the recent titles of proceedings or summaries of information that were produced by
Extension or by faculty working in areas related to agriculture and the environment include:

- **Sustainable Agriculture: Wise and Profitable Use of Our Resources in Nebraska, 1987.**
  Agronomy Extension Specialists, Editors, (221 pp) (1400 copies).

- **Sustainable Agriculture in the Midwest: North Central Regional Conference, 1988.**
  C. A. Francis and J. W. King, Editors, (102 pp) (300 copies).

- **Questions and Answers about Sustainable Agriculture, 1989.**
  C. A. Francis and J. W. King, Editors, (82 pp) (200 copies).

- **Resource Efficient Farming in Nebraska, 1990.**
  A. Franzluebbers and D. Dittman, Editors, (121 pp) (300 copies).

- **National Sustainable Agriculture & Natural Resources Conference, 1990.**
  C. A. Francis, J. L. Bushnell, and R. Fleming, Editors, (163 pp) (1,000 copies).

- **Sustainable Agriculture in Temperate Zones, 1990.**

- **Integrated Crop Management Workshop Proceedings, Extension and SCS, Nebraska Extension, 1992.**

These materials deal primarily with agricultural practices, with emphasis on those that
promote better stewardship: reducing or preventing soil erosion; increasing water storage and
efficient use and reducing or eliminating pesticides by substituting other methods of pest
management. There are some that include environmental dimensions or use an ecological or
resource message to introduce the topic. This appears to be the most practical way to attract
most adult learning audiences to topics related to the environment. Extension audiences
consider materials and programs to be of high technical quality, to be clear and practical, and
somewhat appropriate to their interests and needs. Materials are generally prepared by
specialists located at the UNL campus or at the District Research and Extension Centers; most
faculty at these sites have Ph.D. degrees in specialized areas. Some materials are prepared
jointly by specialists and by agents in counties, and all are reviewed through a rigorous technical
procedure before they reach publication. Topics that relate only to the environment would not
be considered highly relevant by most rural Extension audiences, unless there is immediate
need to meet some government regulation for waste management, pesticide records, or water
quality issue at the local level.

C. **Extension's Sources of Information and Materials** for developing these educational messages are from state, regional, national and international sources. By far the most prevalent is the research base provided by the ARD of the Institute of Agriculture and Natural Resources of the University of Nebraska. With sixteen academic departments and ten interdisciplinary centers, the ARD is the principal public agricultural research organization in the state. From field research conducted both on experiment stations and on farms, experimental results are interpreted and translated into user-friendly recommendations that are reported through the workshops, publications, and broadcasts of CED. The next most important sources are results and publications from nearby states and from federal research specialists working in Nebraska. There is some use made of libraries and national data bases, of technical reports from commercial firms, and from international publications. The majority of information used in Extension is generated within the state by the specialists working under the conditions of the Nebraska farmer and rancher, or in the communities of the state.

D. **An Assessment of the Environmental Content and Messages** contained in Nebraska's extension programs suggests that the activities are well directed in response to immediate challenges faced by producers and rural residents in the state. When there is a new farm benefit program, extension is able to field programs that will help explain the regulations and how to comply with modified farming practices. When there is concern about some human threat to health, such as water quality in agricultural areas, the programs and laboratories can provide the analyses and interpretations needed to assess the problem and suggest solutions. Programs are less well organized to address long-term challenges and environmental issues on a global scale. This is partly due to lack of awareness by faculty or importance placed on these issues; it is partly due to lack of interest on the part of Extension's clients. With increasing
publicity about the magnitude and seriousness of global environmental change, there is likely to be a growing demand for more educational programs and materials in this direction. This will probably require new training for educators, or hiring new people who have different types of expertise.

V. Scope and Extent of Integration of Environment Elements

A. In general, the environmental education activities of extension form an integral part of the mainstream program of meetings and publications. In fact, it would be difficult to promote most current adult activities based only on an environmental message. In contrast, a number of youth programs are closely focused on environmental issues, e.g., 4-H projects on conservation of natural resources and wildlife conservation, high school agricultural units on conservation, water and the nitrate problem.

B. Proportion of extension resources devoted to environmental related education is a relatively small part of the total.

1. It is estimated that about five percent of total subject matter is directly related to the environment; the estimate for formal classroom education for youth is somewhat higher.

2. Extension workers spend full time on these activities, unless they have a split appointment (e.g., 50% Extension/50% Research).

3. About 30% of all subject matter specialists have some expertise in environmental and natural resources management, although few are formally trained in this discipline.

4. It is estimated that less than one percent of the total local, state and national budgets are allocated directly to environmental and natural resources management; of the extension budget, less than 5% is dedicated to these issues.

B. Extent of Coverage of the environmental and natural resources messages must consider the extension, natural resource district, and formal educational classroom curricula; estimates are taken from the most recent census, the state agricultural statistics office, the summaries of activities by extension specialists and agents, and the authors personal estimates.
1. Coverage includes all 93 counties of Nebraska.

2. About 38,000 male farmers are reached each year, or about 50% of the adult male farm population; this includes about one-third of the farm population who are given pesticide safety training each year.

3. About 12,000 female farmers are reached each year, or about 15% of the adult female farm population.

4. Virtually all of the 70,000 rural youth of school age are reached each year through 4-H or through classroom programs.

C. The Scope and Extent to which Environmental Related Education has been Integrated into Extension programs is illustrated in current programs on tillage and residue management, integrated pest management, water quality, and conservation reserve programs. The practices that are environmentally sound must be presented in terms of economic benefit to the farm family, and in terms of improvement of the immediate farm environment. Surveys conducted by major farm magazines indicate that farmers change practices for economic, safety, environmental and philosophical reasons, often in that order. With the continuing publicity about health problems associated with agricultural chemicals and with nitrate in water supplies, there is an increasing awareness of the importance of a search for alternatives. Problems include perceived economic penalties for adopting new practices that reduce or eliminate chemicals, peer pressure from within the farm community to not try new things, and inertia connected with current equipment, products, and practices.

VI. Process of Integrating Environment into Extension Program

The integration of environmental and natural resource issues into the extension program has been a long and gradual process, but one that has accelerated during the past decade.

A. Environmental dimensions have always been a small part of extension, including concerns about soil erosion, recommendations for legume cover crops and rotations, and most efficient use of fertilizers; promotion of increased resource use efficiency has become more
focused since the energy crisis of the 1970s and the environmental awareness including air, water, and soil quality in the 1980s.

B. Decisions to develop materials and incorporate an environmental message have come from specialists and agents in the field, with support and encouragement from key administrators; the process has accelerated since the late 1980s with the introduction of national and state priority initiatives.

C. The strategy of integrating environmental dimensions into extension programs has developed in response to concerns of some farmers and rural residents, pressures from environmental groups, and especially federal regulations directed at pesticide use safety and protection of ground and surface waters. The approach has been to use these issues as introductory comments to convince clients of the importance and relevance of new practices and systems, and then to include economic, health and stewardship incentives among the reasons to consider changing to more environmentally benign practices.

D. Planning in the Nebraska Cooperative Extension Division has always been a cooperative exercise that combines bottom-up and top-down decision making; farmer advisory panels that include both men and women review extension programs of all administrative units for their relevance to current production problems as well as quality of rural life.

E. Extension materials based on university research are produced by specialists and agents, tested with clients and reviewed for veracity and language by colleagues, and used with extension audiences and classroom students. There is growing interest in the use of on-farm research results for making these recommendations.

F. Cooperative Extension works closely with Natural Resource Districts, Commodity Boards, State Department of Agriculture, Center for Rural Affairs, local school districts, Nebraska Sustainable Agriculture Society, and other private and public educational groups in
the state.

G. Extension agents have been trained for sustainable agriculture, erosion control, waste management, and pesticide safety through in-service training sessions; after such training they conduct many of the educational activities in their own districts.

H. Monitoring and evaluation of environmental aspects of programs follows the classical reporting and evaluation procedure of Extension; agents and specialists record numbers of people at meetings, use written evaluation sheets, and get informal feedback from clients.

I. There is no explicit program directed toward integration of environmental aspects into extension programs, although greater awareness among both specialists and clients have moved programs in this direction; availability of some grant funds to develop new materials have stimulated this process (eg. Integrated Crop Management Workshop for Extension and SCS specialists conducted in 1992).

J. Substantial connections of environmental and natural resource issues have been made with the production educational activities in Extension; the primary constraint is the over-riding concern with short-term profitability that will help farmers survive. There is little demand for programs that have environmental issues as the centerpiece, unless they also focus on an immediate local crisis such as a water supply high in nitrate or the need to develop an approved solid waste facility.

VII. Summary of Lessons Learned

A. From the context of the Nebraska case, it is apparent that there is no specific policy or explicitly stated direction that includes environmental/natural resource issues in the on-going extension programs. There has been a rapid growth of these dimensions in extension programs as a result of specialist interest, client demand, government programs and regulations, and administrative encouragement. Recently the name of the College of Agriculture was changed
to include "and Natural Resources"; no similar change has occurred in extension.

B. Cooperative Extension has responded well to client needs related to compliance with new government regulations and entitlement programs; there has also been a major contribution by extension specialists through 4-H and agricultural education programs to environmental curricula. This can best be characterized as "reactive" to the needs of farmers in a changing regulatory environment, and rarely could be considered futuristic in terms of anticipating environmental or resource crises and needs of rural families and communities before those crises occur.

C. The technical basis on which content and messages are based is excellent, and represents a Nebraska-based practical research effort that has credibility and close accountability with clients in the state. The programs are available in all parts of Nebraska, and increasing use of satellite technology is bringing topical programs even more rapidly to all districts. The faculty is dedicated and practical, showing strong client orientation and concern about the future of agriculture.

D. The coverage of environmental and natural resource issues is greatest in the youth programs, both 4-H and classroom education; it is most often incidental in the mainstream extension activities.

E. There is some effective programming of environmental materials into the overall extension programs, especially with those in collaboration with the Natural Resource Districts and the Center for Rural Affairs. There is much less encouragement for including these issues from commodity groups, agribusiness, Farm Bureau and others in the agricultural sector. There is great potential for the pooling of ideas and resources with environmental groups, educational institutions, and private sources to further the incorporation of environmental and natural resource information in future programs.
The degree to which environmental and sustainable development has been infused into extension, research and teaching programs is variable in the U.S. Appendix A presents the results of a survey of all landgrant universities. There has been more impact of sustainable agriculture programs in the Northeast Region and less impact in the Southern Region, according to this survey. The administrators and faculty who responded also included that there has been more impact on extension than on classroom teaching. There is much room for improvement, and greater emphasis should be focused on environmental issues in all of our educational programs.
VIII. References


IX. List of Acronyms

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<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>ARD</td>
<td>Agricultural Research Division</td>
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<tr>
<td>ASCS</td>
<td>Agricultural Stabilization and Conservation Service</td>
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<tr>
<td>CED</td>
<td>Cooperative Extension Division, University of Nebraska-lincoln</td>
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<td>CRP</td>
<td>Conservation Reserve Program</td>
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<td>EPA</td>
<td>Environmental Protection Agency</td>
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<tr>
<td>FIFRA</td>
<td>Federal Insecticide, Fungicide and Rodenticide Act</td>
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<tr>
<td>NRD</td>
<td>Natural Resource District</td>
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<tr>
<td>SCS</td>
<td>Soil Conservation Service</td>
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<td>UNL</td>
<td>University of Nebraska-Lincoln</td>
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AGRICULTURAL PRODUCERS AND ENVIRONMENTALISTS: WHAT ARE COMMON GOALS?

Developed by:
Charles A. Francis

Audience: Extension educators, producers, and lay people

Objective: To begin a discourse on the commonalities of agricultural producers and environmentalists

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AGRICULTURAL PRODUCERS AND ENVIRONMENTALISTS:
WHAT ARE COMMON GOALS?

Chuck Francis, Director
Center for Sustainable Agricultural Systems
University of Nebraska - Lincoln

The differences we perceive in the goals of agricultural producers and environmentalists are both smaller and fewer than what we might conclude from reading the popular farm press. In many ways, farmers and ranchers live closer to the land and to the natural environment than most who live in urban areas and would perhaps label themselves "environmentalists." When urban dwellers discuss the importance of a water supply safe from nitrate and pesticides or the need to reduce off-site drift and effects of applied chemicals, they may forget that people on farms and ranches are the first to drink the water and the first to see their garden wilt from unintended pesticide drift. Those of us in agriculture depend completely on the environment for our income and for what we consider a desirable way of life. We could be called the "ultimate environmentalists!"

What are the conflicts? How do goals of the producer differ from those often labeled "environmentalist?" More important, what are the commonalities of purpose, and how can we improve communication? There are many things that we can do in agriculture to improve both the environment and our image, and much of this is being done. But it is not possible to explore this topic without addressing the issues. There is need for both communication and education. And we need to approach the questions in a broader context than that of the individual farm or decision maker. There are important community dimensions to agriculture -- part of the "quality of life" that we seek as rural citizens. And whatever we do at the local level must be part of a larger global strategy. Let's examine these issues.

What are the Goals of Agricultural Producers?

Our goals as farmers or ranchers vary widely and represent the variation among people as well as families and circumstances. When asked, many would say that the most important thing is to have a profitable operation, and one that will sustain the family for the near future. We also treasure the opportunity to work outdoors, to be independent as decision makers, and to work in a variety of activities, especially if we have a diversified farming operation. The working environment should be a safe one; statistics tell us that farming is one of the most dangerous occupations, more hazardous even than coal mining. We want to preserve our rural environment and the quality of life that comes with open spaces, clean water and air, and a place where crops, livestock, and people can grow. We also function as part of the larger community, and place some importance on the respect we gain from other farmers in the area. There is pride in straight rows, corn planted early, and clean fields. There is some status in using the latest technology, as long as it helps us stay in business. These are evolving goals, of course, as no-till or some alternative becomes more desirable than a field completely free
of residue and weeds. The most efficient equipment may not be the largest, and there is a changing perception of "always getting more land in order to be more efficient or profitable." And we think about the importance of building some security for ourselves and equity for daughters or sons in the next generation. Those who are most successful often would be pleased if our offspring would also like to go into farming. There is some interest in a degree of economic and social equity.

**What are the Goals of Environmentalists?**

We read in the popular press and in the newsletters of many organizations about the growing popularity and influence of groups concerned with specific issues related to the environment: land preservation, birds and other wildlife habitat, access to public lands, water and air quality. There is a large awareness and concern in the general public about water and air quality, use of public lands, and especially food quality and safety. As environmentalists, we are interested in agricultural production systems and other sector activities that don’t harm the ecosystem, and that can be sustained for the long term. It is important for everyone to have a safe working environment, since all of us in society pay the costs of health care. There is interest in wildlife habitat, in multiple uses of water resources including municipal supplies, recreation, and places for migrating birds to visit. Not only for ourselves in the urban environment, we want access to profitable and sustainable jobs for all of the population, and seek ways to develop economically viable and safe communities. We are also interested in some degree of economic and social equity, and access to opportunities for all citizens. Reading through these lists, there is little to distinguish between "producers" and "environmentalists".

**What are the Conflicts?**

There is a perception by some in the urban areas that farmers are using chemicals and fertilizers in an unsafe way, and that this is reflected in unwanted chemical pesticide residues on food and in pollution of the surface and groundwater. Some of this does occur, but we as farmers are obviously concerned about safety and chemical use because we are the ones handling the products, and the first ones to face any danger from exposure to concentrated doses of materials. We’re also the first ones to drink the water. There is growing concern about the amount of federal farm subsidies, and publicity about the misuse of these funds by some of the larger operators. In fact, these farm subsidies are rapidly being phased out, and they have always represented a public payment to reduce the cost of food, increase stability of production, and maintain exports and the economy. A large part of the farm bill is invested in other social programs, including food stamps and payments to specific people in both the urban and rural environment. Some in the urban community believe that more regulations are needed to protect the ecosystem from abuse by agricultural producers. Just as there is regulation in many sectors of our economy, there is some concern by society that is reinforced by government regulation of chemical use, land use patterns, and safety with equipment and chemicals on the farm.
Among the concerns that we have in agriculture are the excessive use of regulation to solve environmental problems, property taxation that seems to unfairly penalize land owners, taxes for gasoline and fees on chemical/fertilizer use, and diversion of land for uses other than farming. We perceive that some of the regulations on chemicals and fertilizer use are designed by people who know little about farming or about the product use, and that these regulations are implemented over a large area when the problem is really confined to some narrow situations. Farmers and others are concerned about public land ownership that removes large areas from the property tax rolls and that push the burden even more onto those with agricultural lands. With urbanization and other uses of land (land fill sites, nuclear waste storage, shopping malls, expanding business), there is significant loss of productive farm land in some areas near larger cities. Purchase of land by organizations such as the Nature Conservancy is viewed with skepticism by many in rural communities and in farming. These are among the conflicts that appear to dominate the conversation when one asks about "agriculture versus the environment."

What are the Commonalities?

If we examine the goals of people and communities, there are many more in common than there are in opposition. In fact, most of us want many of the same things. We may disagree on how to meet those goals. Everyone agrees that we need clean water and air, that job safety is critical both on the farm and in town, and that we need a safe and healthy environment for our children. There is agreement among most that property ownership and a free enterprise system is the basis of much of our economic success, and that some form of this system should prevail for the long-term future. We all want some degree of private land ownership or assured access to that land, whether it is for farming or for a personal dwelling. We agree that there should be equitable access to public lands, and that society must resolve the need for multiple uses of natural resources. No one intentionally designs a business, in farming or elsewhere, to intentionally harm the environment. There is agreement that we need to sustain a nutritious and safe food supply, and that some participation in export of food and products promotes a healthy economy. The advantages of bioregional food systems are obvious, but this does not exclude each region from some participation in a larger, global food system. People need to be willing to pay an appropriate amount for a secure and accessible food supply. There needs to be equity in the system. But these systems are not built entirely by individuals who pursue their own or their family's agendas. We are all members of a larger community, and we need to explore how we fit into that community to meet a broader range of needs. This is another dimension of agricultural producers and the community environment.

What Leads to Successful Communities?

Part of our quality of life in rural areas depends on access to many goods and services that we do not generate ourselves. We need community. Health care, access to food and other products, schools, churches, civic groups, libraries, sports and other recreational facilities are all part of our way of life. These are things that we do not provide for ourselves, whether we live in a rural or an urban setting. Many of these
components of society’s infrastructure are more accessible to people in towns or cities. In a recent presentation at an Ohio Planning Conference, Dr. Cornelia Flora outlined the characteristics of successful communities, based on years of research in the midwest on a wide range of rural towns. Her findings are useful, and show the comparison between towns that appear to be successful and those that are not:

* in successful towns, controversy is considered normal, expected, and a part of the process of participatory governance; in dying towns people avoided controversy, refused to address the real issues, and were antagonistic toward rules and the people who made them.

* people in successful towns held an objective view of politics and did not side with someone out of friendship alone; dying towns personalized politics and could not separate persons from their jobs, and gave loyalty to people rather than issues.

* in prosperous small towns, emphasis was on academics rather than sports; in dying towns they tried to hold people’s interest by promoting loyalty to sports and local teams as the prime identity, and as academics declined, people moved to other towns and toward better schools.

* in successful towns there was willingness to risk for the good of the town, and prosperous towns had enough success to want to risk, and had success because they did risk; dying towns had neither willingness to risk nor success, staying with the status quo rather than trying something new.

* people in successful towns were willing to tax themselves, and moved beyond want and desire into action; dying towns accurately identified needs, but took no action, and they thought someone else should pay the bill or bail them out.

* successful towns had the ability to expand, welcome new people to the community, and build on diversity; dying towns had people who would not share power and authority with newcomers, and small groups held all leadership positions.

* successful towns had the ability to network vertically as well as horizontally; in contrast, dying towns had all lateral learning, and people didn’t want to learn from anyone not exactly like them.

* successful towns were flexible, and had dispersed community leadership with many people involved in the work and the mission of the town; dying communities had a small clique of people who controlled all the decision making process.
How important is our local community to the current quality of life? Are we open to new ideas, and is there a shared governance and feeling that all people belong? What about this total rural environment, including the local community, in our value system and how we spend our time and resources? Do we share the interests and values in preserving a way of life that provides growth opportunities for our children and a way to interface with the larger world? Where would my community be classified in each of the categories above? Are we open to change? All of this is part of our rural environment, and must be a key set of issues as we work together to design the future. But each community cannot be viewed in isolation. We are part of a county, state, regional, and national network of other communities. Our long-term success in maintaining a rural quality of life really must be part of any global strategy that examines our eventual well-being as a human species.

What are the Global Issues?

From the farm and community we need to jump to the global scene, since this interdependent world no longer distinguishes between those in North or South, those with resources from those without. Our human survival and quality of life really involves a global human community. For some ideas we can visit the Santa Fe Institute in New Mexico, a think tank where several Nobel Price winners and people from a wide range of disciplines and countries work together to look at the future. They represent no particular political party, no economic vested interest, no race or religion. This group has listed several needs for society if we are to attain some degree of sustainability for the long term. These ideas are attributed to Drs. George Cowan and Murray Gell-Mann, although they represent the thinking of a larger group of people working in an interdisciplinary team.

The Santa Fe Institute group maintains that global sustainability is primarily dependent on a series of transitions of our economies and societies (reference is Complexity: the Emerging Science at the Edge of Order and Chaos, by M. M. Waldrop, Simon and Schuster, New York, 1992):

* a demographic transition to a stable population: there is no way that we can sustain food production for an ever growing human population. Although there is physical space for many more people, the resources that it would take to produce food and a reasonable standard of living for even twice the current global human population are not available with the current technology or anything that we can envision for the near future. Per capita food production has declined more than 20% over the last two decades in Africa, and there is little indication that this trend will change. We are nearing the practical limits of growth in human numbers.

* a technological transition to cause minimal environmental impact: current food production systems and especially manufacture of goods are not as resource efficient as they could be, even using known and available technology. We need to design systems that can meet basic human needs, and help us discriminate
between needs and wants, so that these needs can be met in a way that does not drastically change the ecosystem nor deplete our finite supply of many natural resources. There is need for equity in North and South, and equity in food supply and opportunity within countries as well.

* an economic transition to charge real costs of goods and services: it is essential that people be willing to pay the full costs of food and other products, including the long-term environmental costs, so that the world economy can live off nature's "income" rather than off its "capital". We currently subsidize the cost of food and other consumable items, and pay the costs of extraction of many natural resources rather than the real long-term opportunity costs of not having those resources for the future. We need a science of long-term and environmental economics, rather than an accounting system for short-term profits.

* a social transition to a broader sharing of income: there is a global need for increased opportunities for nondestructive employment for poor families around the world, so that they can participate in the global economy and raise their standards of living. A nation or a world in which large inequities exist is not a peaceful place to live, nor is this sustainable for the long term.

* an institutional transition to supranational alliances: the concept of nation states is one that must quickly give way to regional and global alliances that facilitate a world-wide concern for global problems and allow various aspects of policy to be integrated with one another. This is beginning in meaningful ways with the NAFTA and GATT agreements, controversial as they may be in current form. The Rio de Janeiro conference on Global Concerns in 1992 brought together many ideas from countries and organizations around the world that can help provide a "greenprint" for this change in concept of national sovereignty. We are all living in one world, and it is time to consider our decisions on that basis.

* an informational transition to include all people in decision making: scientific research, education, and global monitoring all provide us with more information about the current state of economies and the environment, and this information needs to be widely available so that people can become full participants in global decisions. It should not be in the realm of only the politicians, or the multinational corporations, or any other exclusive group to plan and implement the future. We all have a vital stake in the decisions that are made, and just as we need participation in the local community we need this activism on the global front.

Agricultural Producers are Environmentalists

Given this background, there is an important need for new coalitions in agriculture. With the importance of food for survival and the growing concern about a livable ecosystem, we are all part of an "environmental movement" that will determine how successful humans can be as a species. We need to participate actively in the
educational process, help people become more connected with their food supply, and seek ways to work with current environmental groups in this country and around the world to build a sustainable future. We have spent enough time pointing fingers and establishing an "us versus them" situation. It's time to work together.

Activities (for students or Extension meetings)

1. Use the attached work sheet as a preliminary device to get people thinking about the goals that underlie a farming operation, goals for the family, perceived goals of "environmentalists", primary conflicts.

2. Break the group into pairs or small triads to briefly discuss major goals, first on the farm, then for the local community, then for "environmental groups." Report back on major shared goals and conflicts.

3. How do our goals on the farm contribute to success in the rural community? How does activity at the local level relate to the global issues summarized by Cowan and Gell-Mann?

4. Discuss the premise that "environmentalists are the best friends and the greatest hope for building a broader concern about agriculture; the people we should be most concerned about are those who are not concerned or involved about where their food comes from or how it is produced."
AGRICULTURAL PRODUCERS AND ENVIRONMENTALISTS:
ARE THERE COMMON GOALS?

Strategies & Ideas in Sustainable Agriculture

1. What are your primary goals for the farming operations?
   *
   *
   *
   *
   *
   *

2. What are your primary family goals?
   *
   *
   *
   *
   *
   *

3. What are the primary goals of "environmentalists"?
   *
   *
   *
   *
   *
   *

4. What do you consider the primary conflicts between producers and environmentalists?
   *
   *
   *
   *
   *
DESIGNING THE FUTURE
FARMSCAPE

Developed by:
Charles A. Francis

Audience: Educators and Producers

Objective: To determine cultural practice for retaining value on farm
To explore value added enterprises on farm

This material was prepared with the support of USDA Agreement no. 92-COOP-1-7266. Any opinions, findings, conclusions or recommendation expressed herein are those of the authors and do not necessarily reflect the views of the U.S. Department of Agriculture or the University of Nebraska.
DESIGNING THE FUTURE FARMSCAPE

1. Producer proportion of the value of food in the U.S. system (Stewart Smith graph)

![Graph showing marketing, input, and farm shares over time]

2. Cultural practices for retaining value on farm, input substitution:
   - corn rotation for rootworm management
   - alfalfa fertility contributions to corn
   - crop scouting for insecticide decisions
   - moisture monitoring and irrigation scheduling
   - ridge tillage for reduced primary land preparation
   - weed scouting for appropriate herbicide decisions
   - nitrogen budgeting for cost effective nutrient management
   - use of manures or compost as source of nutrients

3. Value added enterprises on farm, in community
   - diversified farmscape and additional crops
   - feeding livestock, other animals on farm
   - processing on farm and direct sale
   - elaboration of packaged products
   - direct produce sale, community supported agriculture
   - diversity of products, outlets, marketing strategies

190
SUSTAINABLE AGRICULTURE: DESIGNING FUTURE SYSTEMS

Developed by:
Charles A. Francis

Audience: Educators and Producers

Objective: To determine different perspectives on agricultural ecosystems
To explore barriers to sustainable agriculture

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1. Agricultural Ecosystems revisited: What are different perspectives? Why do we see the world differently?

2. Key challenges or barriers to overcome:

3. Economic challenges to Nebraska farmers (Dr. Stewart Smith, Senate Econ. Comm.)

Marketing, Input, and Farm Shares
4. Concept of Sustainable Agriculture:
   - definition:

   - practices:

   - conditions:

5. Will the system respond to future challenges?
   - environmental dimensions:

   - resource limitations:

   - economic problems:

   - social questions:

6. References:

BIODIVERSITY IN SUSTAINABLE AGRICULTURAL SYSTEMS:
HOW PAST EXPERIENCES SHAPE OUR VISION OF THE FUTURE

Developed by:
Charles A. Francis

Audience: Extension, SCS, and ASCS Professionals

Objectives: To raise questions about our current practices

To understand the importance of boundaries and limits

To develop strategies for thinking in the long term

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Biodiversity in Sustainable Agricultural Systems:
How Past Experiences Shape Our Vision of the Future

The most exciting area in future studies could be called "Process futurism", an activity that Joel Barker (1989) describes as learning how to think about the future. Barker describes the powerful influences that our life experiences have on how we view the world, and how we follow a current prevailing paradigm. He defines a paradigm as a "set of rules and regulations that: 1) defines boundaries; and 2) tells you what to do to be successful within those boundaries." Barker’s video, "Discovering the Future: The Business of Paradigms", explores the nature of human experience and how this shapes our interpretation of what we see around us. His work builds on previous authors, including Thomas Kuhn who described the concept of "paradigm shifts" in the realm of science. For Kuhn (1962), scientific paradigms are:

"accepted examples of actual scientific practice -- examples which include law, theory, application, and instrumentation together that provide models from which spring particular coherent traditions of scientific research." (The Structure of Scientific Revolutions)

Barker also cited the work of Adam Smith (1975), who described a paradigm as:

"a shared set of assumptions. The paradigm is the way we perceive the world; water to the fish. The paradigm explains the world to us and helps us to predict its behavior. When we are in the middle of the paradigm, it is hard to imagine any other paradigm." (Powers of the Mind)

According to Joel Barker and other futurists, it is difficult for us to contemplate change when we view the past and present only in the context of what is and has been. We find it close to impossible to see beyond the established and accepted boundaries. When the rules change (e.g. cost of fossil fuels, perceived negative impacts of atrazine in water supply, end of the cold war), those of us in science generally do not adapt easily or quickly to new constraints, opportunities, or realities. The stark contrast between prevalent crop monocultures and alternative, biologically diverse cropping patterns provides a good example what is known and accepted today and what might be desirable in the future. Barker states that major changes in current systems are likely to come on the boundaries, and that "paradigm shifters or pioneers" operate at some risk on the frontier of accepted science and thought.

Relevance to Agriculture:

Most of us subscribe to a rather narrow set of accepted rules and procedures for "doing science in agriculture". We know what experimental designs and how many replications are needed. Experience has shown what methods of adult education work best. Of course we are growing some new crops and using appropriate advanced
technology, but this came about in an orderly and well understood fashion. The marketplace will sort things out. We will have somewhat less water in the future, so we need to search for more efficient cultural and irrigation practices. Since some of today’s pesticides are likely to be removed from the market, it is important to continue work on breeding for pest resistance. Such thinking shapes much of our research and extension agenda. Joel Barker would call the pursuit of these narrow goals within the accepted boundaries a form of "paradigm paralysis".

Perhaps we are too close to the issues, in our immediate research agenda or adult education program, to even realize that we are bounded by limits that constrain our vision:

* in a geographic sense (farmers believe what they see on their own field or that of a neighbor, rather than what was done in another state or country)

* in a temporal sense (we don’t want to "go back to organic farming", or to have to worry about integrating livestock again into the operation)

* in a current experience framework (all we see are crop monocultures, thus it is difficult to imagine how else crops might be grown in a biodiverse pattern in the field)

* in a conceptual sense (our comparative advantage is component research — let the farmers put these pieces together, since they know best their unique constraints and resources in each field)

* in a religious sense (pursuit of science is value free, since we study the biological and physical components and influences in agricultural systems, and such issues as stewardship, economic equity, environmental impact, and human health will be sorted out by others in society)

**Life on the Frontier:**

There are always some researchers or Extension specialists among us who operate on the frontier. They study new crops, alternative methods of providing nutrition or protection to plants, participatory educational methods with adults, the structure of agriculture and its impacts on society. These are the risk takers, the innovators, the "paradigm shifters or pioneers" (Barker’s terms) who may fail; they are the colleagues among us who may have difficulty making tenure, or staying focused on the same job, or fitting into our current dominant university community. How do we recognize and reward these risk takers, and what is their potential contribution? Are they the most likely people who will provide solutions to such difficult challenges as:

* Why do we continue to build houses and pave shopping malls over our rich soils?

* How do we condone unsustainable ecological situations such as the one which
finds close to 15 million people in a small, three-county area of southern
California that requires massive importation of water, fossil fuels, and food?

* What are the economic and social adjustments needed to develop an equitable
society that provides jobs for those who need them, fosters incomes that will
allow people to live from their own efforts, and provides food and other
necessities for all people?

* How do we shift from an economy dependent on production and sale of military
hardware to one that contributes to peaceful, sustained economic well-being on a
global scale?

If a research or Extension specialist at our land grant universities, a classroom
teacher on any of our campuses, or a country SCS office specialist begins to pursue some
of these issues with targeted research or education programs, will they be recognized or
rewarded within our organizations? How will these key issues be approached, and by
whom? What is the relevance of this type of broad issue compared to the narrow topics
that we normally include in our research projects or classroom curricula? Or must we
leave these issues to other people or agencies?

To answer these questions about our agriculture, we need to examine our current
research and educational paradigms. Our experiences influence how we see the world
and how we make decisions for the future.

References:

Lake Elmo, Minnesota.


Kuhn, T. S. 1962. The Structure of Scientific Revolutions. Univ. Chicago Press,
Chicago, Illinois.


(Based on a presentation at U. C. Davis, Nov. 1992)
DESIGNING THE FUTURE

Developed by:
Charles A. Francis

Audience: Extension, SCS, and ASCS Professionals

Objectives: To consider the role of the university in designing the future of agriculture
To discuss new directions for University research and extension

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DESIGNING THE FUTURE: THE UNIVERSITY’S ROLE AS AN AGENT OF SOCIAL CHANGE

We can view the future in two ways. The first way, by far the most prevalent in our culture, is to extrapolate from the past through the present to estimate where we will be in a certain number of years. Thus we can predict the world’s population or total fertilizer use by the end of the decade. We can speculate on farm size in California or Australia, on the price of corn or almonds, or the size of the national debt by the year 2025. Such an exercise could be called imagining the most predictable future, and an appropriate course of action would be to decide how best to adapt to that future. Another approach, one described by the futurist and philosopher Joel Barker, is to project to a specific time in the future and decide on a most desirable state for the farm, the community, the region, or other frame of reference. Once this desirable future is described, we can begin to make decisions today to make that future happen.

In his exciting video, "Power of Vision", Barker expands on this theme. It is a message of empowerment, a positive statement about how we can make a difference, a design that calls for participation of all the players who are interested in making this desirable future happen. Barker visits three sites where people under extraordinary conditions have created a vision, followed through on their plans for the future, and found ways to realize those dreams. He concludes that "dreams without action are just an illusion, and action without dreams is just passing the time. But action that is guided by dreams can change the world."

Relevance to Agriculture:

What is the role of the university in helping citizens to design the future? Given the need for our clients (students and extension meeting participants) to find jobs or solve immediate problems, can we burden them with excessive rhetoric and questions about the future? Are we really an institution that should be proactive in the direction of social change? Some specific examples are useful to illustrate the potential future role of the university as a catalyst in the process of building awareness and lifelong learning.

Farmers and ranchers in the U.S. today must make management decisions within a climate of great uncertainty. In the feed grains business, midwest producers are highly dependent on fragile export markets and international currency fluctuations. With many acres enrolled in government farm programs, they are limited in crop decisions and required to follow certain environmentally sound production practices. In many cases, there is a limit to the acres that can be placed in rotation of program crops with others that could help build the soil, provide crop protection, and diversify the cropping landscape and economic environment within which decisions are made. It is difficult to envision the future beyond the next decision on a federal farm program each year. In this climate of change, it is impossible for us to teach menus or solutions that will have lasting relevance. The best contribution we can make is to lead students and others through a discovery process that results in an understanding of how programs work, what
the consequences of alternative decisions will be, and how to evaluate the economic and other impacts of their decisions in the future. In this way, each producer can envision her or his own most desirable future scenario, and then put in motion the decisions to make that happen.

In the relatively homogeneous, feed-grain based agriculture in the midwest, there is reliance on a handful of crops for economic success: corn, wheat, grain sorghum, soybean. With the majority of farmers now in the cash grain business, there is little potential for value added through livestock on the farm. These specialized managers follow a fragile route that can be undermined by changes in climate around the globe and production in other grain exporting countries, by modifications in U.S. farm programs, by fluctuations in international currency markets, and by other factors far beyond the farm gate. These farmers are interested in diversification, in new crops, in "silver bullets" to reduce risk and make farming more profitable. We attempt in research and extension to provide these options, but have great difficulty with a limited university budget in expanding the information base on a number of new crops or animal enterprises. One solution has been a generic approach to empowering clients to generate or gather and evaluate their own information on alternative crops and enterprises. We are designing a NebGuide that lists all the initial questions that producers should ask when considering a new enterprise. This will include growing, harvesting, processing, and marketing the products. Those who enter a new product area first are those who have the best chance to succeed. Such entrepreneurs will be way out ahead of competitors, and certainly ahead of a university research/extension program that counts on multiple years of data and deliberate analysis of results before making recommendations. This "generic approach" to evaluation of alternative enterprises will be one route to profitable diversification for our Nebraska farmers.

These are but two examples of how we can approach the future in crop production, looking at potentials of more diversified crops or markets, and how we could add value to current, low-value feed grains. The same process can be followed in reducing production costs, using practices that are more environmentally friendly, or building a completely new marketing scheme such as "community supported agriculture". What is more often lacking is the capacity to look outside the current systems (or paradigms) in agriculture, and envision new approaches that could be both profitable and sustainable for the long term.

Potential New Directions:

To find the new frontiers and to take action to explore them, it's important to think about how current systems could be changed to meet tomorrow's needs in society. Here are several potential new directions in research and education that may be a part of the future scenario for our universities and for agriculture:

* greater reliance on teams in research and education: current trends toward centers of excellence, team-taught courses and curricula, and broad participation
by several specialists will accelerate, as we work to bring systems-related
information to clients.

* **flexibility in team organization and budgets:** these teams will be more fluid
than at present, with individuals moving in and out of task forces with specific
goals; budgets will be adjusted regularly to reflect priorities and needs of each
team/department.

* **distance learning opportunities:** place-bound and non-traditional students will
be able to access a broad array of formal and informal courses through satellite
and computer networks; more information will come into the campus by
electronic technologies.

* **education as a life-long activity:** the boundaries between different levels of
schooling and between classroom teaching and extension will begin to blur, and
these will be accepted as closely coordinated components of a long-term
educational process.

* **electronic information networks:** university libraries or extension could become
the network managers for information networks that tap into resources from
scientists, extension, farmers, industry, federal government, and other plays in
the ag scene.

* **education of general public about food systems:** critical to the future of
agriculture is the broadening of our education agenda to enlighten urban
populations about the importance of production agriculture and the source and
safety of our food supply.

* **broadening awareness of the time and space continuums:** current focus on
short-term goals and solutions as well as on events and challenges close to home
will give way to a concern about the longer-term future in broader geographic
areas.

References:

Report No. 114.


1 in: *Sustainable Agricultural Systems*, C. A. Edwards, R. Lal, P. Madden, R. H. Miller, and

Univ. Press, Ames, Iowa.

(Based on a presentation at U.C. Davis, Nov. 1992)
A GROUP DISCUSSION ON SUSTAINABILITY OF AGRICULTURE AND RURAL COMMUNITIES

Developed by:
James W. King

Audience: College students; could be adapted for community groups

Objectives: People will develop generalizations about sustainable agriculture and rural communities

Method: Have people read C. Flora's chapter; discuss the following questions in a class period or assign the questions as a take-home exercise. (Flora's chapter could be adapted or summarized as a handout.)
SUSTAINABILITY OF AGRICULTURE AND RURAL COMMUNITIES

A discussion or out-of-class assignment based on a book chapter by Cornelia Butler Flora


1. Having read the section on "Economic and Cultural Background of Rural Communities," give examples of two economic and cultural shifts. How has this changed the (your) local community?

2. Would you agree that the four trends -- the increase in farm size, increased mechanization, specialization, and intensification -- have occurred in the farm (your) community? Can you cite examples? What would you say have been the effects of these trends?

3. Flora says there will be a growing dependence on (1) diversified sources of debt, equity, capital, and income; (2) economies in marketing and production; (3) asset portfolio manipulation; and (4) use of sophisticated technology, such as computers, risk management strategies, and paid consultants. (p. 349) Do you see these things occurring in the rural (your) community? Provide examples. How will these growing dependencies help the rural (your) community?

4. There are seven attributes of entrepreneurial rural communities. Rank them in terms of importance to you. Describe the one which you feel is more significant. Which one do you disagree with the most? Why?

5. The author says sustainable agriculture will contribute seven factors to help viable rural communities. Do you agree that these factors will occur? Why or why not? Comment on one.

6. Every community has farmer entrepreneurs. Find examples and describe two or three. How do these entrepreneurs relate to the community?

7. Can you offer an example of new people coming into farming? Who are they? What backgrounds do they bring to the enterprise? Have they brought innovation? If so, in what ways? If not, why not? What have been the barriers to innovation?

8. Given the insight from this article, develop several generalizations about sustainable agriculture and rural communities. Discuss these with other students in the class. Make a group list of the generalizations. Determine some ways to organize or categorize them.
9. List two or three things you have learned from this exercise. Is there more information you would like to have about sustainability of agriculture and rural communities?
TEACHING NOTES ON:

SUSTAINABILITY OF AGRICULTURE AND RURAL COMMUNITIES
by Cornelia Butler Flora


Community...an area in which groups and individuals interact as they carry on daily activities and solve common problems (p. 343).

Functions which communities perform: providing opportunity for making a living, socializing community members, exercising social control, participating in group activities, and caring for those in need in crisis situations (p. 343).

Question: How does a shift to more sustainable, low-input agriculture affect the ability of a community to solve its common problems and carry on the functions communities perform? (p. 343).

1. Economic and cultural background of rural communities (p. 344).

1.1 Macroeconomic shifts and shifting factor costs

Because of past factors (land became a speculative investment, not a productive one; cheap capital encouraged high levels of agricultural inputs; then, capital became expensive), much of the damage to "small community main street" caused by reduction in purchased inputs has already been done.

1.2 Increasing separation of producers from consumers in markets

Agricultural specialization and a large government buffer between producers and markets tended to isolate rural communities as well as farmers.

1.3 Increasing internationalization of agriculture and the U. S. economy

Rural communities increased their international dependency but not their international awareness.

1.4 Increasing importance of off-farm income in rural communities.

A high proportion of farmers nationwide now get most of their income off the farm. This means there is less time for farm management. There has been a related increase in agricultural related services.

1.5 Over commitment of resources to agriculture
Cheap capital and inflated demand caused by subsidies has caused an over commitment of resources -- too much labor, too much land, too much capital in agricultural production -- to agriculture.

1.6 Implications for rural communities

There were four trends -- increasing export dependence, increasing use of capital, increasing importance of off-farm income, and increasing dependence on federal intervention -- are highly related to (1) an increase in the number of large farms, the growth of small, part time farming; (2) increased mechanization; (3) specialization; and (4) intensification.

2. Options for rural communities through sustainable agriculture

There will be a growing dependence on: (1) diversified sources of debt, equity, capital, and income; (2) economies in marketing and production; (3) asset portfolio manipulation; and (4) use of sophisticated technology, such as computers, risk management strategies, and paid consultants. (p. 349)

2.1 Characteristics of viable rural communities

They have active participating citizens, in collective problem solving.

2.2 Entrepreneurial rural communities

They have attributes such as: (1) acceptance of controversy as normal, indicated by a weekly newspaper willing to print controversy; (2) long-term emphasis on academics (compared to sports) in the school; (3) generation of enough surplus, often from slightly larger than average family farms, to allow for collective risk taking; (4) willingness to invest that surplus to local private initiatives; (5) willingness to tax themselves and to invest in the maintenance of rural infrastructure; (6) ability to define community broadly, so that consolidation has meant large boundaries for small communities, not a win-lose battle; (7) ability to network vertically and horizontally to direct resources, particularly information to the community; and (8) a flexible, dispersed community leadership.

3. The contribution of sustainable agriculture to viable rural communities (p. 353)

3.1 Management intensity and complexity

This will create new services in the community.

3.2 Cost-Minimization
There will be a reorganization of the financial and retail trade in rural communities to more service-oriented, diversified kinds of investments.

3.3 Diversified farming systems

Diversification make the economy of the entire community more stable.

3.4 Better links to consumer/markets

Orientation to the consumer's concern for food quality increases the price per unit available, and thus the economic gain to the community as a whole.

3.5 More participation and responsibility in community affairs

Links to larger community institutions will force the increased participation of farmers.

3.6 Legitimation of innovation

Sustainable agriculture is innovative, requiring a shift from old patterns to new ones.

3.7 Making capital available for nonagricultural development

Shifting capital away from agriculture will free capital for nonagricultural development.

4. What will happen to businesses based on high-input agriculture? (p. 356)

Farmer entrepreneurs have emerged, i.e., the dealers themselves are farmers. Small incremental change will soften the economic shifts. More off-farm jobs, and better off-farm jobs should develop.

5. Quality of community life and sustainable agriculture (p. 357)

Low-input agriculture combined with low land prices could encourage the entry of innovators into farming who could help add dynamism to rural communities.

6. Conclusions (p. 357)

Sustainable agricultural practices are not antithetical to viable rural communities. Environmental quality will improve.
A DISCUSSION ON LEARNING AND TEACHING

Developed by: James W. King and Charles A. Francis

Audience: Educators in formal and non-formal settings

Objective: To discuss the differences between learning and teaching
To arrive at a personal definition of learning and teaching

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A DISCUSSION ON
LEARNING AND TEACHING

1. In groups, describe a time or event when you learned something. What was the process? How did you know you learned? How did you feel? Who was involved? What was the setting like?

2. From the group experience, list and identify factors related to a positive learning environment.

3. Individually, think of a good teacher you’ve had. What “teaching” activities did that person engage in? What types of teaching styles did you observe? How were you drawn into the content? How did that person handle process concerns?

4. For your own involvement, describe a good teaching environment.

5. Discuss the differences and similarities between learning and a good learning environment, and teaching and a positive teaching environment.

6. In your own words, define and describe learning; in your own worlds, define and describe teaching. Within the group, discuss your definitions to find commonalities and dissimilarities. Refine your own definition. Change them over time as new experiences provide you with new insights.
Learn

- memorize, remember, retain;

- discern, deduce, determine, glean;

- understand, get, master, pick up, read, realize, study;

- practice, drill, perfect, prepare, rehearse, repeat, review, study;

- ascertain, determine, catch on, discover, find out, hear, listen, uncover, unearth.
Teach

- ingrain, infuse, imbue, impart, inject, inoculate, instill, invest, penetrate, pervade, spread, steep, suffuse, train;

- educate, train, coach, communicate, condition, convey, cultivate, develop, discipline, drill, edify, enlighten, exercise, explain, groom, imbue, impart, implant, improve, inculcate, indoctrinate, inform, infuse, inseminate, inspire, instill, instruct, perfect, practice, prepare, ready, school, tutor.