Future Education in Ecological Agriculture and Food Systems: A Student-Faculty Evaluation and Planning Process

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ABSTRACT. Three graduate-level short courses on ecological agriculture and food systems were held in 1995-1997 in Norway to introduce systems thinking, creative research methods, and innovative learning approaches. In 1999, a three-day evaluation and planning workshop was held to assess course impacts, to determine relative importance of content areas, to compare learning methods with special attention to case studies, and to vision and develop action plans for future education in the region. Students and faculty agreed that soft systems research methods and varied learning processes in the course were more valuable than specific technical content that can be learned in other venues. Nine priority education areas were identified for ecological agriculture: (1) systems thinking, (2) research methods, (3) farmer/stakeholder participation, (4) improving production methods, (5) relating agriculture to food systems, (6) learning about learning, (7) values and ethics, (8) faculty development and institutional change, and (9) agricultural and food policy. We explored current knowledge and future educational importance of each area, and found that case studies can integrate many of these topics. Four specific priority educational needs were identified through visioning toward an action plan for the region: (1) publish a Nordic teaching text in ecological agriculture, (2) expand the network of educators and researchers with a short course for faculty, (3) broaden the focus from farm production to food systems by including additional disciplines and themes, and (4) coordinate thesis research activities in ecological agriculture among universities. Evaluation and planning were efficient and productive in this short workshop, due to prior organization and creating ownership in the process and the future education plans, and all participants were involved in writing this final document.
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INTRODUCTION

Education in ecological agriculture is growing in importance throughout the Nordic-Baltic Region. New courses on each university campus, special-topic short courses, and thesis topics dedicated to this theme are examples of change. These courses incorporate and build on recent published experiences in participatory and experiential learning. A number of recent initiatives in northern Europe have contributed greatly to conceptualizing and implementing innovative learning, both in linking ecological and social systems (Berkes et al., 1998) in

designing new university education and extension programs (Röling and Wagemakers, 1998).

At the postgraduate level (term used for MS and PhD studies in Europe), it is important to understand and practice the appropriate research process, including writing and presenting results (Sammis and Mexal, 1996). Problem-based training is a key contributor to learning, and student teams can research specific problems and develop practical recommendations (Salvador et al., 1995). One goal is to develop both team-oriented and self-directed graduates who can communicate results to clients and the general public (Fletcher and Branen, 1993). Short-term residential courses have been explored for training in specific techniques, and have employed a range of learning approaches (Woods and Miller, 1995). The case study method has been used to move students into the community to deal with real-world problems, develop diagnoses, and present these to clients (Olien and Harper, 1994).

One activity designed by a network of educational innovators in the Nordic-Baltic regional network is the one-week, intensive short course supplemented by prior readings and by later reflection and report writing (Tigerstedt et al., 1998). Three such courses in ecological agriculture for post-graduate (MSc and PhD) students have been held in Stange, Norway (Lieblein, 1995, 1996, 1997):

- Research Methods in Ecological Agriculture, 1995 (22 students)
- Systems Research in Ecological Agriculture, 1996 (20 students)
- From Farming Systems to Food Systems, 1997 (18 students)

These courses were designed to meet several objectives. For many postgraduate students it was essential to introduce the concepts and research methods in ecological agriculture. Others needed ideas and methods for development of thesis research projects. Each year there were students and faculty with a valuable range of opinions and experiences from different disciplines that led to rich discussions during group exercises. Also important were systems thinking and analysis, using new research tools (especially soft systems methods), and evaluating participatory research methods.

For each course one objective was to explore innovative learning approaches that recognized students and faculty as co-learners, building on all participants' expertise in this educational environment (Ison, 1996). We elevated the importance of organized discussions and group

work in the educational process. Topics in the three courses are shown in Table 1. Case studies played a key role each year in the workshops; they were constructed and simulated in 1995, involved actual farms in 1996, and expanded to encompass the whole food system in 1997. Evaluation of participatory learning methods showed these to be new to some of the students, yet most adapted well to the changed learning environment. Some of the lessons learned from the workshops have been summarized (Lieblein et al., 1999a, 1999b).

An evaluation and planning process for designing future education in ecological agriculture is described here. Students and faculty from six countries who had been in previous courses met for three days on an ecological dairy farm in Norway to evaluate the three past courses and chart an educational direction for the future. Visits to case study farms, group discussions, structured questionnaires, and team writing were among the activities used to envision the future of education and establish an action plan. In the workshop we eliminated the faculty versus student distinction, and hereafter speak only of "participants." We describe the process of evaluation, reaching consensus, and developing directions for the future.

WORKSHOP GOAL AND LEARNING OBJECTIVES

The goal of this workshop was to evaluate three prior courses and develop action plans for future PhD-level education in ecological agriculture, all based on experience of participants in the previous Nordic courses. Specific learning objectives and expectations of workshop planners were framed as questions.

- What impacts did the courses have on students' research and thinking?
- What relative importance should different content areas have in future courses?
- Could we compare learning methods and importance of learning about learning?
- How important was the integration of farming and food systems?
- Can we evaluate group visioning as a design method for future courses?

TABLE 1. Topics included in ecological agriculture courses, Stange, Norway, 1995-1997.

1995: Research Methods in Ecological Agriculture

Visits to three ecological mixed enterprise farms
Agriculture and social capital
Emergence of ecological agriculture as an alternative
Agricultural research in all its dimensions
Overview of Nordic agriculture and research
Design and farming systems
Research method and tools
Systems approaches to ecological agriculture
Social science research methods for ecological agriculture
Excursion to Maihaugen and Lillehammer, historical museum
Group projects and presentations

1996: Systems Research in Ecological Agriculture

Multiple visits to three ecological farms
Systems research and ecology in agriculture
Agricultural research in an agroecological perspective
Reconstructing agriculture–the case for local knowledge in agricultural research
Poster presentations of current research by all students
Excursion to ecological farms in Gudbrandsdalen and Lom Valley
Group projects and presentations

1997: From Farming Systems to Food Systems

From farming systems to food systems
Bioregionalism and ecology
Linkages among farming systems and communities
From production systems to dietary systems
Multiple visits to three ecological farms
Poster presentations of current research by all students
Basic concepts and tools needed for case studies
Visits to processors and marketing groups
Visits to local county politicians and decision makers
Panel discussion with consumers of ecological food
Excursion to ecological farms in Gudbrandsdalen and Lom Valley
Group projects and presentations

EVALUATION & PLANNING WORKSHOP PROCESS

Introduction: An introduction statement was drafted before the workshop and provided to participants for study, reflection, and editing during the first day, and their comments incorporated into the final paper.

Workshop goal and learning objectives: The goal was developed in consultation with faculty and supplied to students with the workshop invitation. Specific learning objectives were provided at the start of the workshop, and participants were encouraged to modify these and share their expectations during the first session.

Evaluation of retrospective opinions: A one-page questionnaire was distributed to participants and completed during the first session. Results provided the list of key educational areas to be explored.

Prioritizing educational areas: Another questionnaire was completed the first night of the workshop, and means for relative importance of seven previously identified areas, plus a list of other areas, were posted the next day. After the group decided on nine areas of emphasis, a short discussion and writing session used volunteers for each of the key educational topics to produce rough drafts of the nine sections.

Visioning for future programs: A third questionnaire was redesigned after the prior exercises, and given to participants before we discussed future design of learning activities. Results were posted for reference during focus group discussions of future activities and learning plans.

Workshop conclusions: Results of questionnaires and writing exercises were summarized, and ideas were incorporated into a workshop final report. This was copied onto computer disks and given to each country team before they left the workshop. We asked all participants to reflect on the workshop and send us their comments within one month. An electronic version of the paper was sent to all participants, who provided comments before preparation of this final manuscript.

RETROSPECTIVE ON ECOLOGICAL AGRICULTURE COURSES

Participants summarized their current perspectives on what the course had provided, in terms of technical content, new research tools and learning methods, networking opportunities, and decisions and

attitudes about ecological agriculture. There was general agreement that the course provided a range of positive outcomes, and it was apparent that using new learning methods was the most valuable experience. The lowest rating was for technical content. Participants recognized that the main emphasis of the course was on demonstrating and practicing new learning processes, more about 'how to learn' than learning in specific content areas. They appreciated opportunities to explore new learning approaches, as well as generally expanding both knowledge and access to information about ecological agriculture. This confirmed our third learning objective for the workshop, that participants could compare learning methods and also that they could assess their own learning styles.

Specific comments provide a rich picture of what people gained from the course. "I learned new things about organic agriculture, but more was needed on research methods for complex problems." From another, "The course encouraged me to go and look for new research tools; what we need are tools to analyze the farm from different viewpoints." Echoing colleagues in natural sciences, one person said that "Soft systems tools such as mind mapping, activity calendars, and others were useful and new to me." Learning methods were highlighted by most people, e.g., "There was good changing of styles, participatory group opportunities, small and large group activities, and team decisions. Also, the grounding of learning in real life situations using case studies was critical." "I learned more about the creative process and communications, and this enabled an understanding of multiple ways of learning." Several remarked about the importance of building their regional network of colleagues. Another important area was holistic thinking and attitude toward ecological agriculture. "I came out very convinced of this direction for the future, and its relevance to agriculture in general." "The condensed study of three farms (case studies) in a region showed the potentials of development based on existing farmer knowledge about their farms, and the necessity of the systems approach came out clearly." One remarked that "the course was tremendously rewarding and inspiring," and another that the course "was a keystone in my career," this latter from a faculty participant. These comments provided insight on relative importance of content areas (second workshop objective) and confirmed the importance of case studies (fourth workshop objective).

IDENTIFICATION AND ELABORATION OF IMPORTANT EDUCATION AREAS

The relative importance of seven education areas was evaluated through a questionnaire and small group and plenary discussions. These areas were systems thinking, research tools, farmer/stakeholder participation, improving ecological agriculture, ecological agriculture related to food systems, learning about learning, and values and ethics. Impacts on participants in the courses were highest in systems thinking and learning about learning, while values and ethics were the least changed. There was an increased appreciation of the importance of farmer and other stakeholder participation in research and education. In the open-ended discussion, the group added five useful educational areas from their course experiences: scientific criteria for ecological agriculture, sustainable thinking, connecting research and development, agricultural and food policy, and faculty development and institutional change. The last two were chosen by the group for more detailed elaboration of educational needs and future plans.

Discussion and writing sessions were used to expand seven key educational areas with small groups (two to five people); two additional sections were written by individuals. For each content area, we focused on why it is important, the current state of knowledge and education, and its importance for the future. Participants volunteered for writing tasks in the areas of their specific interest and expertise.

1. Systems Thinking (Mikko Loiva, John Porter, Laura Seppänen)

The meaning of some phenomena cannot be fully understood unless approached in context of a system. Our best understanding of the behavior of sub-components comes from viewing them as parts of a greater whole. Systems can have qualitatively distinct properties at different scales and hierarchical levels, and discussions are confused if there is not a common accord on explicit system boundaries. Systems thinking by necessity leads to the promotion of networking in order to understand components and how they fit together. Specific concepts often used to describe sustainability are equilibrium, steady-state, balance, rates and states, and these are interfaced with principles in ecology to better understand both structure and functioning of systems.

Currently, systems thinking is limited, due in part to our organization by traditional academic disciplines. Even within those boundaries

we often discuss small pieces of each discipline. There is a need for systems approaches to problem solving, for learning ways that systems are organized and how they function, and for study of systems as a unique area of inquiry. We need examples of applications of systems thinking in design of agricultural production plus processing, marketing, distribution, and consumption of food. Only in this way can we understand the important cycles and interactions that should be a part of the structure of future systems.

Integrative systems thinking in the future can help us put other components into perspective and better understand how systems operate. We need generalist skills as well as specializations in science. Specialists will benefit with a broader appreciation of where components fit into a system. Decision and policy makers need better tools such as systemic analysis. Even in ecological agriculture, we often have to reduce the scale of a research study to a manageable level, thus study sub-systems in order to understand the mechanisms that operate in larger systems. Key study areas for the future include history and philosophy of systems thinking, marketing and consumer opinions, and the unique role these areas play in ecology and ecological agriculture.

2. Research Methods or Tools (Chuck Francis)

In the assessment of the three courses, learning about research methods/tools was seen as an area for greater emphasis. We think that additional methods are important to students from the sciences, especially if they want to broaden their perspectives and begin to look at more economic and social systems dimensions. Many students commented during the courses about need for more methods in the social sciences, how these should be used, and time to discuss and apply them. There was concern about the absence of useful tools for resource and whole-farm system analysis, and how to use such results for planning.

Research methods available in most disciplines are often not widely known by students in other fields. Important in education is a cross-training among disciplines in how to evaluate systems from different perspectives. Most important is the exchange of methods between natural and social scientists, where we can quickly broaden our frames of reference and expand our capacities to understand the intricacies of agricultural and food systems. Models often are linear, while what is

needed is to better understand current and potential cycles of nutrients, water, labor, and biotic elements that make up biological systems.

We consider the elaboration, development, and use of research methods to be central to the acceptance of systems thinking and further research. Although students can be expected to locate, test, and evaluate current tools as well as develop some new ones, we can facilitate the process by helping them gain access to state of the art research methods in all fields relevant to ecological agriculture.

3. Farmer/Stakeholder Participation (Merit Mikk, Chuck Francis)

To understand what is really going on in the farm or the food system, it is essential to become immersed in that environment. Farmers or other professionals knowledgeable in the food system have much practical perspective and information to offer both students and researchers in the education process. In ecological agriculture, there is a need for students to stay for at least one month on a farm. Working with farmers helps bridge the gap between current science and practical applications–it can bring more credibility to both research and researcher. On-farm research studies over the past decade have helped create better communication and stimulated applications of technologies. Close working relationships will generate more support for research and education in the future, a factor equally important in processing, marketing, policy, and other parts of the food system.

A wealth of literature has emerged on methods and application of participatory, on-farm research (e.g., Francis et al., 1995). Farmer research rings in Norway have been testing cereal varieties for decades. A cooperative 21-farm study has been initiated in Estonia to locate the weak points in the production system, this in cooperation with the Danish Institute for Agricultural Science. There is a high degree of awareness about the importance of on-farm research, especially participatory research, but to date most of the methods used for this work are quite conventional: standard research designs, replication, control of most factors, and standard analyses and accounting procedures for success on a whole-farm basis. There is need for well thought out research methods that fully incorporate the farmer into the process, and include ways to study and evaluate whole-farm systems in biological, economic, environmental, and social terms.

We strongly feel that on-farm and food system research will become much more important and should be part of the education agen-

da. This is because of the emerging importance of ecological agriculture, lack of current information on many crops, practices, and systems, and awareness that these will be economically essential. It is difficult to switch from conventional to ecological production systems, and equally difficult to think outside the existing research paradigms that focus on the experiment station and carefully controlled experiments. Students need an opportunity to learn new techniques, and this should be done early in professional education. Practical results can make an impact on the farm and in the broader agricultural sector.

4. Improve Ecological Agriculture (Svein Solberg, Gõran Ekblad)

To improve ecological agriculture we need to identify key issues that limit its development and adoption. Without this analysis, it is possible for researchers to work for decades on problems that are interesting but produce results that have little impact. Priority problems must be selected and then solved through rigorous research. Then it is important to aid in the information flow to clients who will apply the ideas and results. This process is as important as the results themselves, and can add efficiency and veracity to research results.

In each country, there are currently recommendations on specific practices in ecological agriculture, as well as some methodology for the conversion process. Research on these aspects should continue. There is a large need for systems dimensions of research, biological and economic interactions that make systems work, and importance of how farming systems fit into the landscape and how they influence local communities. There is an open frontier for further research on the impacts of farm size and ownership, effects of consolidation in the commercial sector, and other systemic dimensions of the food system.

The growth of ecological agriculture in many countries and growth of trade in ecological products make this an attractive research and education area for the future. To identify problems, an important approach is meetings with farmers, researchers, extension workers, and representatives from the market. When all participate in identifying key issues, they will be more likely to be engaged in a research process that leads to more relevant research and solutions. Problem solving can be a learning process both for farmers and scientists and provide feedback to others in the food system. Newsletters, web sites, journals,

courses, and scientific publications can be used to move results to many audiences in the food system.

5. Ecological Agriculture Related to Food Systems (Hanne Torjusen, Svein Solberg, Juha Helenius)

Ecological agriculture has local goals, related to resource cycling, social connections, networking, and local food security. These are set by and related to people in local communities, in contrast to multinational corporations and shareholders in a globalized conventional food system. Those concerned about local systems address food security and issues of access to land and other resources, as well as access to food in a global context and whether ecological agriculture can feed the world.

Education in ecological agriculture is underdeveloped, especially in terms of what happens after the farm gate. There are limited guidelines for processing and marketing. How to organize an optimal organic system is important, e.g., standardization of products, reliability, and seasonality of local production. Eating lower in the food chain, consequences of organic food for health and nutrition, and economics of local food systems need to be addressed. Values in the food system should be explored. What are the impacts of eating organic and vegetarian food? What is the balance between global and local systems? Although many questions are local, everyone today is linked to a global production food system.

Goals for sustainability must be formulated, and more attention given to local food system issues. One important task is to find methods to measure and assess ecological, social/cultural, and economic sustainability. How should this be communicated to consumers? Consumer awareness, labelling, and certification are relevant, as well as tracking the dynamic relationships among supply, demand, prices, and food value of organic produce. How do we internalize costs that today are totally externalized and passed to other areas geographically or to future generations? Food system level questions require both production and consumer research, for current knowledge to be included in education. The food systems approach will become increasingly important as a part of future postgraduate education in ecological agriculture.

6. Learning About Learning (Wenche Barth-Eide, Lennart Salomonsson)

Universities and their graduates need to adapt rapidly to changing circumstances in society, especially important in the vital food systems area. In a global society, information sources are numerous and often conflicting. We need to process more information and deal with greater complexity as we seek the best estimates of truth. Fortunately, our ability to learn is also increasing.

Recent years have seen an enormous amount of research on the learning process and its consequences in pedagogy at different levels. We know that learning needs stimuli of both brain parts, a confident learning environment, and an understanding of the processes of learning by the learner. This means that learners can be given responsibility for their own learning. We recognize the natural tendency to search for knowledge "downwards" in hierarchies of information, while learning is often organised "upwards." We also know that knowledge is a function of information and processing, and that change or learning depends on attitudes toward learning as well as skills in the process. These principles can be applied in ecological agriculture.

The challenge for educators is to apply a modern understanding of learning processes so that graduates can constantly contextualise their actions and become autonomous, life-long learners. Universities need to be in constant dialogue with society to become positive actors in societal development and at the same time develop themselves as learning organizations rather than remain dogmatic institutions with inflexible structures.

7. Values and Ethics (Helena Kahiluoto, Vonne Lund)

Contrary to common wisdom about scientific research, there are no actions nor decisions that are completely value-free. As in other parts of our lives, we are confronted with choices of actions, and choice depends largely on values. Thus it is important to make these values explicit. It is rational to recognize that there are inherent values and understand how these influence interpretation and evaluation of results in each context. Values are critical when research questions are formulated and prioritized. Ecological agriculture is based on explicit values formulated in the Nordic Platform for ecological agriculture, a regional IFOAM group, in 1989.

Presently there is not much work published, but there are current projects and activities. Two PhD-projects in Sweden are related to values and ethics in ecological agriculture, and in Denmark there is a group working with bioethics. Awareness and interest for these questions are increasing. The education offered today is scattered and not included in most of our current courses or other educational activities.

Questions regarding ethics and values in ecological agriculture will have increased importance in the future. Nordic countries are developing research methods and projects in ecological agriculture, and the value base is important in decisions and priorities. It is possible to include value questions and ethics in education on all levels, and include philosophers and ethicists in interdisciplinary teams. We plan to start Nordic co-operation in a project dealing with values and ethics, and the historical and philosophical evolution of ecological agriculture.

8. Faculty Development and Institutional Change (Hanne Olsen, Paula Persson, Nadarajah Sriskandarajah, Geir Lieblein)

Current institutional structure with discipline-specific departments does not help us meet the needs of ecological agriculture, where we need an approach that is both integrated and systemic in nature. Universities need systems teams that span departments, work across department lines, seek cooperative activities with groups outside the university, and are open and curious about exchanging information as a two-way process. There are many faculty with deep rooted and conservative attitudes about organization, and these are reflected in our institutions. Administrators who are overly caught up with internal budgets and other struggles may have limited understanding of what is happening in the outside world and how to facilitate new innovations when they are brought in. This hinders development of new areas of study.

Formal staff development for teaching is not adequate in our institutions. Thematic days, teacher training seminars, and pedagogic service units provide faculty with some opportunities, but we generally assume that a person who has achieved an advanced postgraduate degree through research is automatically qualified to teach. Superb academic achievements, excellent publication record, and other academic honors do not guarantee teaching ability nor interest. Most university

teachers "learn on the job" and continue learning through their careers. Wide appreciation of the need for good teaching as well as the need for institutional change comes from numerous visioning and planning sessions, yet these remain a quandary for most universities.

Ongoing focus on staff development and institutional change are essential. Funds need to be invested in these areas to foster ecological agriculture within our curricula. We must keep our universities' focus on the primary goal of education. There is currently valuable political lobbying and support coming from the community for ecological agriculture. We need to generate support both within the university and from the general community .

9. Agricultural and Food Policy (Wenche Barth-Eide)

The systems approach to ecological agriculture includes working with the community. This goes beyond the farm and immediate local stakeholders in the food chain and includes people in broader society, government, non-government, and special interest groups. Research methodology and education should include the identification and study of constraints and opportunities at all levels, including policy research and dialog with people shaping agricultural and food policy.

Policy research and education currently take place in faculties of economics and political science, both quite disconnected from agroecology and study of the food system. Food is seen as a commodity, or at best as one small human activity system generally unrelated to the natural environment or the resource base.

We propose that policy be incorporated into research and educational programs in agroecology, and that two specific activities be initiated. Policy research for ecological agriculture and food systems includes a mix of technological issues, underlying vested interests in the food system, conflicts of interest, and understanding the need for food sufficiency at the family, community, and national levels. Interdisciplinary research groups are needed in each country to look at appropriate policy research, initiate dialog with government officials, and identify relevant stakeholders in the food system. This is action research, and can be part of education. There is also need for policy training: courses, curricula, and practical experience in policy for students interested in future work in the food system.

VISIONING AND DESIGN OF FUTURE LEARNING ACTIVITIES

Design of future learning activities for postgraduate students was accomplished through small group discussions, a final questionnaire, and a plenary planning session. Building on experiences of students and faculty in three previous courses, we assembled lists of priority knowledge and skills needed, discussed where the learning activities for these would most logically take place, and explored the needed types of learning. Participants rated educational topics with high, medium, or low priority, and indicated whether this education should be in classrooms, short courses, special topic workshops, internships, thesis work, or elsewhere in the community.

By far the most important topic was systems thinking, a subject often placed in the center of a mind map by each group as they discussed materials or concepts to be included in future courses. In the next tier of topics were research methods to enable systems analysis, scientific criteria for ecological agriculture, and sustainable thinking. Ecological agriculture as integrated into food systems was also important. Areas next in ranking were farmer/stakeholder participation, learning about learning, values and ethics, and institutional change. We concluded that the courses were effective in building skills to analyze the importance of different content areas (objectives one and two) as well as comparing learning methods (objective three).

Three focus groups took different approaches to visioning the future. Group A discussed the importance of looking at reductionism versus systems perspective, and how this could be explored by interdisciplinary teams through a hierarchy of thought, from philosophy to science, to research approaches, to general methodologies, to specific methods. They concluded that scientists' responsibilities extended far beyond adding fragmented pieces of knowledge, and should reach the important task of assembling these pieces within the current context of farm and community. Group B touched on the same issues, and added details on systems methods such as boundaries, hierarchies of systems, and scale of investigation. They also explored the importance of setting research priorities and the publication and other criteria that shape our reward system. Group C emphasized the importance of farmer participation in the research process, how scientists can add both rigor and validity to their work, and why we should maintain our research focus on serving agriculture.

All groups agreed that students were our primary clients in education, but that multiple stakeholders in agriculture should also be both subject of study and part of the educational process: farmers, other researchers and educators, advisors, administrators, food processors, wholesalers and retailers, input dealers and suppliers, administrators, politicians, and NGO people and lobbyists. All are involved in change in agriculture, and all should receive attention during our planning of education. We concluded that group visioning was an efficient and valid approach to synthesizing ideas for future courses (objective five).

We also identified action steps or activities to meet these educational needs:

1. *Publish a Nordic book on ecological agriculture*: Current literature available in ecological agriculture in the region is mostly available in thesis format, in technical journal articles, and in practical bulletins for farmers. There are texts from other parts of the world that are used in our courses, but not specific to this region with examples and context that can attract students and help them better understand our regional resources and constraints. There are unique dimensions of Nordic and Baltic culture that affect agriculture and food systems. Important topics are system thinking, historical and scientific basis for ecological agriculture, ecological principles and ecosystem functions, design of managed ecosystems in agriculture, multiple functions of agriculture, and evaluation and design of ecological food systems. Books that are useful models include Altieri (1995), Gliessman (1998), Lampkin and Padel (1994), Loomis and Connor (1992), and Tivy (1990).

2. *Maintain and expand the network of Nordic-Baltic educators and researchers*: There is a need to provide continuing opportunities for networking among faculty, students, and others in the region. This can be done through regional working groups, workshops and postgraduate courses, and exchange of students and faculty, as well as electronic means-bulletin boards, conferencing, and mailing lists. Space should be created in courses for students to initiate this networking, and special topics such as research methods for systems could be attractive to keep participants involved. We need to attract and orient more faculty to present courses and serve as advisors for students in ecological agriculture. A short course for instructors and advisors will concentrate on needs of students, methods for research in this area, and

types of support that are needed from supervisors of thesis research. The goal is to broaden the perspectives of supervisors in systems thinking, learning processes, research methods, and ecological agriculture.

3. *Broaden the focus from agricultural production to integrated food systems*: Region-wide we need change of focus from production details to the multiple steps and cycles in the food system and the multiple objectives of agriculture. To include food systems will require faculty with other experiences, a more comprehensive set of learning resources that include processing, marketing, and consumption, and a structuring of courses and research to address a wider range of challenges. Such topics as policy making and subsidies for ecological agriculture, role and regulation of GMOs, government and non-government agency involvement in food, landscape and community issues, and broader continuing education opportunities are among the topics for learning and research activities.

4. *Coordinate research activities in ecological agriculture*: There are many good reasons to organize and implement a coordinated research program in the region. Universities are small and budgets more constrained each year. There is enough similarity among the agroecozones that information and recommendations could move easily across the region. By pooling resources and working toward an integrated research agenda, it will be easier to make more progress and share results. It is also important to assure that this research complements what is already in progress.

WORKSHOP CONCLUSIONS: VISION FOR THE FUTURE

There was consensus that the courses in ecological agriculture were successful experiences for students and faculty. We also concluded that a major benefit from postgraduate courses was continued networking and exchange of information that takes place parallel to the organized program. Some activities provided better learning experiences than others. Highly rated aspects of the workshops included farm visits and case studies, methods such as interviewing and group projects, and systems perspectives for research. For some participants, the reinforcement by colleagues with similar interests was a major benefit. Among the less important aspects of the courses were the

technical content with respect to specific technologies, the material on values and ethics, and the ideas about how to improve ecological agriculture. As a faculty, we learned that students want more concrete examples to back up theory, and many insist on our establishing a scientific base for the design of ecological food systems.

For the future, our design of educational activities should be informed by the results of the surveys and group discussions. Systems thinking, new and appropriate research tools, scientific criteria for decisions and designs, sustainability ideas, and getting farmers and other stakeholders involved in the research and education process were seen as important. There was less agreement about where and how much of this revitalized education should take place in short courses. Many felt that concepts and materials should be incorporated into conventional courses as well as short courses and workshops. The use of internships was seen as important for getting farmer and stakeholder participation, as well as a route to improvement of ecological agriculture. The thesis project was seen as an activity to practice systems thinking, use appropriate research tools, and get more involved with stakeholders.

We concluded that this type of evaluation workshop is valuable to participants for a number of reasons. One student remarked that it was stimulating to be accepted as an equal during the workshop process, and that she felt highly empowered by the group to express her opinions and have them validated. One faculty member expressed thanks to the group for his own professional conversion in thinking and career, and said that the network in the region continues to provide valuable support. The residential short courses provide a unique opportunity for students and faculty to focus clearly on priority issues and to share experiences and results in a welcoming and collegial atmosphere, and this type of educational activity should have high priority for the future.

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