Bridging farmer experience and science: learning for agroecological design of sustainable farming systems

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Key words: experiential learning, agroecology, farming, food systems, phenomenology

Abstract

Bridging the gap between academia and farmers requires unique learning methods, teaching based on multiple information sources, and instructor willingness to embrace the importance of farmer experience as a legitimate resource. Agroecology is emerging as one holistic field that includes farming and food systems, and integrates production, economics, environmental issues, and social dimensions in education. We explore how biophysical and socioeconomic characteristics and research methods are important to understanding human activity systems related to food, and we use examples from organic farming, permaculture, multiple cropping, crop/animal, and local systems to expand student understanding of food security and food sovereignty. Instructors are mentors and co-learners using phenomenology and practical experience with stakeholders in a carefully designed educational journey through the food system learning landscape. The Agroecology MSc Program is used as a case study.

Introduction

Bridging the gap between academia and farmer experience is crucial in developing learning programs using phenomenology. Agroecology is an integrative and holistic approach to study agricultural and food systems. Understanding farmer systems and ecological principles as foundation, focusing on uniqueness of place in farming design, shifting from disciplines to holistic perspectives, and integrating human dimensions are all essential. Farmer experience in organic farming, multiple cropping systems, permaculture, and crop/animal systems provides teaching examples to bridge theory and practice. On-farm discussions with farmers build communication skills and confidence in working with stakeholders. Learning agroecology as the *ecology of food systems* includes production, economic, environmental and social factors in future systems design (Francis et al., 2003). Experiences here are based on more than a decade of teaching in at the Norwegian University of Life Sciences (NMBU).

Learning methods

Methods of guiding students through an agroecology learning landscape and developing greater capacity to communicate with stakeholders are imbedded in the curriculum of a MSc course in classroom and field. The course begins with transect walks across farms and natural landscapes to develop multiple senses to understand the farming context (Francis et al. 2012). Students work on farms and interview farmers in an initial exercise, learning key interview techniques and designing relevant questions to make best use of the farmer's time (Ostergaard et al. 2013). Interviews are designed to learn about current farmer systems and their rural context. Focus on ecological principles in classroom, discussions, and farm conversations provides understanding of farm, field and enterprise niches, uniqueness of place, and that one system does not fit all circumstances (Altieri 1983). Importance of holistic thinking and moving from discipline-based to transdisciplinary approaches is fostered in lectures, discussions, and interviews with farmers (Lieblein et al. 2008), and in reflections by students who summarize field experiences and draw mind maps to organize information from farms they have visited (Breland et al. 2012). Integrating understanding of people at the heart of the human activity systems we call farming is accomplished by maintaining continual focus on decisions and designs that farmers develop in choice of practices and farming systems each year. A visioning process is introduced in class and in the field with clients (Lieblein et al. 2011). By practicing these methods with farmers, and engaging a wider stakeholder group in study of community food systems,

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students gain confidence in dealing with those who design and implement changes in the system, and thus become better prepared for responsible action in the future (Lieblein and Francis 2007). The educational process has been successful in a one-semester full-immersion module in autumn term at NMBU (30 ECTS) and in an on-line introductory agroecology course in spring term taught by instructors from four Nordic universities (5 ECTS). In these courses, we recognize the multiple interpretations of the term *agroecology* as a science, as a set of practices, and as a movement (Wezel et al. 2009), and encourage students to explore all three as an integrated and holistic approach to learning.

Results

When students work on farms, even for one day, they begin to learn first-hand about the rigours of farm labor and rural life. They also learn to value the criteria of farmers and why they have designed their current systems, plus how these relate to the science that they have learned at the university. An important next step is to understand the foundations of ecology and how these apply to present systems and how they could be used for future systems design. To appreciate the multiple and complex connections in farming and food systems, we find it essential for students to think outside the traditional disciplines in our agricultural education and research system, and to develop skills for whole systems thinking. These whole systems include the farm owner or manager who designs the farming system and selects the practices, and those professionals who are part of the food system as teachers, advisors, and government officials. Results in each of these areas and how we have observed student learning is discussed in more detail.

1. Learning from indigenous systems and building bridges to science

It comes as surprise to some students that our courses give major attention to farmer experience at the same time as we are exploring principles of science and especially ecology. The full day of work on biodynamic farms in the second week of the course have focused student energies on tasks selected by the farmers, and tasks have ranged from harvesting onions and potatoes, to stacking firewood, to cleaning livestock barns, and even to searching the forest for lost goats that had likely been killed by wolves. In each situation, students felt that they were contributing labor to activities considered important to the farmer, and in a way exchanging their time for what the farmer provided to them during the interview and farm tour. On numerous occasions farmers have invited students for lunch where they have joined the family and farm interns in a valuable discussion of farming and some details about the specific operations.

Experiences such as combing the forest for goat carcasses provided high adventure, and exposed students to the risks inherent in livestock raising in remote areas of summer pasture. They learned about the personal strength needed to work alone, at a distance from the farm and the safety and companionship of others. The team that stacked wood all day could be seen as pursuing a totally menial task, yet their reports of discussions on alternative sources of fuel, renewable energy options, and life cycle analysis of timber as it compares to other means of heat and power revealed the rich learning experience that was generated from within the group. We were not sure at the outset if this would be seen as useful by farmers and a worthwhile investment of limited learning time by students, but both groups have confirmed the value of the exercise.

Yet more important than the social experience of getting to know farmers and families as people, and more than the high adventure of perhaps sighting a predatory wolf in the forest, were the gains in understanding the farming system and the reasons why certain enterprises and practices were chosen to fit into the context of a certain environment and set of natural and human resources. The students learned that green manures and composting provided viable alternatives to chemical fertilizers on these farms, that farmers could live with a low level of weed infestation in fields, and that biodiversity in the field margins and natural areas on small farms were part of the total ecosystem. The experiences provided a bridge to the principles they had learned previously in classes, and students were learning about holistic farming design using ecological models as the starting point. This is a clear bridge between farmer experience and science.

2. Building farm and food systems designed using ecological principles

Central to agroecology is the application of ecological principles to design farming systems that are more dependent on internal, renewable resources and less on imported fossil fuels and their derived production inputs. Nutrient and water cycles, natural methods of pest protection, and conservation of energy through practices that mimic the functions of natural ecosystems are emphasized in texts and journal articles in agroecology (eg. Gliessman 2007). Research in science to better understand how structure and function in alternative systems contribute to productivity and stability has increased in recent years, although there is still a domination of the chemical and industrial paradigm in most education in agriculture. One of the best sources of empirical data, perspectives, and applications of ecoprinciples is still the collective experiences of farmers.

Although experienced farmers on the ground may not use the same terms as scientists in universities, farmers possess a wealth of information and practices that need to be observed, evaluated, and incorporated into a comprehensive agroecological education for students. Obviously not everything is correct, nor can all practices be widely applied. This is where student and instructor energy, careful consideration of the literature, and common sense come into evaluation. We have found that student observations of farmer practices and the ideas gleaned from interviews can be highly instructive in helping us all bridge the gap between farmers and university. Although we are hesitant to challenge the conventional wisdom of practices that appear to work on a particular farm, we can inquire together with students about how and why a specific activity is successful, whether that is consistent with research information, and how important context can be in the evaluation of practices and results. This is a learning process that involves students, farmer clients, and instructors working together to 'bridge the gap'.

3. Shifting from disciplines to whole systems thinking

Implicit in the agroecosystems analysis of farms and food systems is the importance of shifting beyond comfortable disciplinary boundaries and into the mode of whole systems thinking. The classical disciplines, as well as ecological principles, are all human constructs that we use for convenience to understand and communicate about components and systems. Farmers are by nature holistic thinkers, although they may appear to focus down on specific components such as which hybrid to plant or what weed management strategy to apply. While conducting interviews with farmers, our students at times express frustration with not being able to get answers to all their pre-designed questions. Their clients may pursue what appear to be tangents to the questions, while in fact they are hoping to communicate the complexity of problems and how so many issues are connected. This is a good lesson coming from interviews, and students profit by the broad perspective uncovered by interviews even while talking about specific practices and rotations. Multiple crops and crop/animal integrated systems are particularly interesting because of the complexity of their structure and the multiple objectives farmers have in their design and expected diversities outputs.

4. Integrating the human dimension into evaluation of food systems

Perhaps the most complex challenge for students is incorporating the human component into their thinking and analysis of systems. This is likely due to their prior focus on the biophysical and economic issues, one by one, without explicitly thinking that the bridges that link all the components are more than nutrient/crop interactions or responses to irrigation, but are obviously related directly to the human management of the system. Students uncover incredible complexity on the farm, and even more in community food systems. They grapple with how to understand complexity by using a series of 'agroecosystems analysis' tools, including social science methods, and strive to use science to put a foundation under what are observed as practical and functioning systems on the farm and in the community (Rickerl and Francis 2004). These provide essential perspective for designing potential future scenarios, our preferred output from student teams, rather than specific solutions or rigid recommendations.

Conclusions

We conclude that the agroecology MSc course in autumn at NMBU provides both safe space and a stimulating team environment that fosters systems learning as well as gains in confidence for communicating with a range of stakeholders in the field. Communication is key to bridging of knowledge from farmers and other clients and academic science from the university. Through multiple interviews and data collection in the field, access to official statistics, use of tools from both natural science and social science disciplines, and reflection on results students are empowered to learn about complex farming and food systems and to use the results to design potential scenarios to present back to their clients in the field. This learning approach is then applied to a thesis project that culminates the agroecology MSc degree, and phenomenology as a foundation for learning has proven successful for more than a decade in agroecology at NMBU.

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