

NORWEGIAN UNIVERSITY OF LIFE SCIENCES





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## **Abstract**

A change in the common education strategy is vital for securing an environmentally, economically, and socially viable future for the food system. This is a case study of how concepts within the education for sustainable development (ESD) framework are applied in the graduate agroecology programme at the Norwegian University of Life Sciences (UMB). Which elements of agroecology education are transferable in working lives, how effective learning strategies are for developing reflective lifelong learners, and how former students are able to partake in the sustainable development of the food system are examined. Semi-structured in-depth interviews were conducted with five former students. While the initial motivation for studying agroecology mainly were interests in thematic areas of food system functioning or agriculture, participants gained methodological skills, tools and knowledge related to lifelong learning and transferable systems analysis, which to varying degrees they apply to their working lives. Students generally found open-ended learning effective. The study illustrated the negative consequences of the lack of a strong agroecology identity, which may be strengthened by linking agroecology formally to the global ESD approach. A whole school approach to ESD will strengthen the programme's ability to develop reflective practitioners in sustainable development.

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## Introduction

Despite an increase in environmental education, the environmental and development crisis continues. According to the economist E.F. Schumacher, the environmental and development issues will not be alleviated by *more* education, but a *change* in education (Schumacher, 1999). In 2002, the United Nations General Assembly implemented United Nations Decade of Education for Sustainable Development (DESD) from 2005-2014, led by the United Nations Educational, Scientific and Cultural Organization (UNESCO). Matsuura (2006) states that a sustainable future requires alterations in attitudes and behaviours, a task which is attempted through education for sustainable development (ESD). UNESCO (2007) describes ESD not a set of rules, but as a framework for educational programmes of all disciplines to provide students with tools, skills and knowledge for tackling environmental, societal and economical sustainability issues. The unique local conditions are respected, while keeping in mind the global effects of actions. Teaching methods are based on high order and participatory learning. It is applicable at all levels of education, as well as in informal education. Lifelong learning is encouraged, to reflect the evolving conditions of sustainability.

ESD is flexible and allows for regional-specific focus on sustainable development issues and has become part of some national education strategies around the world (Wals, 2009), such as the Norwegian ministry of education and research's *Strategy for education for sustainable development for the period 2012-2015* in primary and secondary school, day-care centres, and teacher education (Kunnskapsdepartementet, 2012). UNESCO (2006) lists the following elements as characteristics of ESD: interdisciplinarity, value-driven, critical thinking, multi-method, participatory learning, action learning, and local and global considerations.

*Sustainable education* as described by Sterling (2001), is an educational paradigm based on the ecological worldview which embodies the characteristics of ESD. A guiding metaphor for the ecological worldview is that of the world as an organism rather than a machine. This metaphor captures the interactions, interdependence, and participative quality of the worldview. Embedded in this paradigm is the idea that how we view the world shapes the way the world is. Sterling (2001) lists examples of the ecological paradigm in ecological thinking and in practical applications, such as ecological design, ecological agriculture, and business organization. However, the growing ecological perspective is a worldview which yet has to manifest itself in the common education paradigm and practice. Whole systems thinking at its

foundation, the idea of wholeness is found in the vision, image and design. The education paradigm based on the ecological worldview can be contrasted with a mechanistic paradigm

According to Salomonsson et al. (2004) students must be familiar with tools and problem-solving skills in order to be prepared for the complex challenges of the sustainability of the future food system. The authors state that “motivation must be developed as an effective incentive for learning” (p. 7). Likewise, Glasersfeld (1995) believes that students who see the use of what they are learning will be more motivated. Teachers in agroecology at UMB aim for students to be more interested in their own learning than what they think the teachers expect from them (Østergaard et al., 2010). Correspondingly, in sustainable education, student must feel ownership of their learning, requiring education to be meaningful, engaging and participative, which are the key elements of sustainable education (Sterling 2001).

Bateson (2000) distinguished three levels of learning. First order learning is passive, taking in information. Second order learning requires reflective and critical examination of the knowledge gained in first order learning. Third order learning is transformative, entails a shift in worldview, critically assessing assumptions, and according to Sterling (2010), the type of learning sustainable development requires. Third order learning is more challenging and may even be discomforting, as it may involve an examination of one’s own assumptions and view of the world.

In ESD, learning is an important force for tackling issues which have arisen from unsustainable practices. The Masters of Science in Agroecology (M-AE) at the Norwegian University of Life Sciences (UMB) is an example of an education programme which attempts to embody elements of ESD. Though there is no formal link between the programme and UNESCO’s Decade of Education for Sustainable Development, the programme clearly embraces characteristics of ESD through its vision, image and design, various pedagogical methods, exposing students to systems thinking, and involving students in the local community. The methods employed are described below.

Agroecology is defined by Francis et al. (2003) as “the integrative study of the ecology of the entire food system, encompassing ecological, economic and social dimensions... [embracing] the wholeness and connectivity of systems” (p. 100). In agroecology, the study, management and design of food systems goes further than agronomic considerations to include natural, economic, political, socio-cultural aspects. The agroecology programme is an international interdisciplinary programme which aims “for students to become facilitators of change toward

sustainability in our food systems” (Lieblein et al., 2008, p. 311). Methods from social sciences and the natural sciences are used to understand the system (Francis et al., 2003). Agroecology at UMB uses “experiential learning as the pedagogical base for understanding complex systems and action learning as the starting point in the field” (Francis et al., 2003, p. 111). In the initial semester, students are exposed to systems thinking in evaluation and design of food and farming systems. Agroecosystems are dynamic and complex, requiring practitioners to be lifelong learners. Reflection on actions and on personal learning is emphasised throughout the semester and students gain a theoretical basis of learning theories to help them become lifelong, autonomous learners. Learning does not end with the completion of one’s formal education. Therefore, students of agroecology are encouraged to develop lifelong learning skills, through exposure of learning theories and the examination of their own learning styles, through Kolb’s learning cycle.

ESD functions as a guideline and is not a concise description of methods or theoretical basis, but allows for adjustment according to the educational institution’s unique conditions. The UMB Agroecology programme’s learning approach is based on phenomenology. Phenomenology is a philosophy of knowledge which considers the human experience significant for understanding. It is a non-dualistic philosophy, meaning the subject and object are not seen as separate (Dahlin et al. 2009). Moran (2002) explains that it is a method of describing a phenomenon without imposing pre-conscripted notions from religion, tradition, and science. The word *phenomenology* was first used by Hegel in 1807. The German philosopher and mathematician Edmund Husserl (1859-1938) is regarded as the main contributor of phenomenology who developed phenomenology into the theory of knowledge which it is known for today (Østergaard et al. 2008). Husserl called for a methodology which shows the relation of scientific knowledge to everyday experience. He saw the need for an alternative to Cartesian dualism and naturalism, which is generally accepted in science education. Cartesian dualism and naturalism do not consider the practitioner’s experience as part of the process. Husserl emphasised the need to *do* phenomenology. Unlike his well-known student and further contributor to phenomenology, Martin Heidegger, Husserl regarded phenomenology as a “rigorous science” (Østergaard et al. 2008). According to Fløistad (1991), phenomenology is a systematic attempt of integrating philosophy, science and life.

In science education, Husserl argues, scientific knowledge is disconnected from experience. Husserl saw his phenomenology as a foundation for both social and natural sciences (Dahlin



2003). He saw a trend towards *mathematisation of nature*, which started with Galileo's manifestation of mathematics as being the true language of nature (Dahlin 2003). Harvey (1989) calls this acceptance of mathematical models as truth rather than experience the *ontological reversal*. According to the ontological reversal, abstract theories and models based on the invisible world of nature, are accepted in everyday life and seen as more real than the everyday experiences of the phenomenon (Dahlin 2003, Østergaard et al. 2008).

Practitioners of phenomenology in science education aim at bridging the gap between theory and practice (Østergaard et al. 2008). This involves a reduction of the difference between the science world and the lifeworld, since students often have difficulty connection lessons at a practical level (ibid). Husserl describes the *lifeworld* in *Crisis of the European Sciences* (1970) which Østergaard et al. (2008) describe as “the pre-reflective world of everyday experience” (p. 96). According to Dahlin et al. (2009) the conventional science teaching methods alienates students from nature by creating an abstract world of formulas and models. The sensory perception of nature is not relatable to the nature described. This is particularly a phenomenon of physics, mathematics and chemistry.

Science teachers practicing phenomenology “regard lifeworld phenomena as the very basis, and not mere illustrations, of scientific knowledge” (Østergaard et al., 2008, p. 98). Science students develop their understanding of nature through the exposure to phenomena. Rather than starting with the solution, or the scientific theory, the phenomenology practitioner starts with a general question which is understandable to students at a personal level. Before the theory is brought to the table, students are given a chance to deliver their reasoning, based on observations.

Students of the agroecology programme at UMB start with the introductory course PAE 302: *Agroecology: action learning in farming and food systems* in the first autumn semester. The course has undergone several changes over the years, though it is has consistently been based on the same fundamental pedagogical methods of action learning, action research, Kolb's learning cycle, phenomenon-based learning and experiential learning. These methods have the common objective to decrease the distance between the “real world” or the “lifeworld” and the world of the classroom.

Action learning, which is learning through action with an emphasis on reflection, can be divided into four stages; experience, reflecting, conception of an improvement plan followed by action, resulting in a learning which ideally has a balance of introspection and

experimentation (McGill and Beaty 1992). Action learning in higher education is a way for students to acquire skills transferable to the work force (ibid.). It abolishes the terms “outside world” and “real world” since students partake in real food systems, rather than the theoretical system of the lecture hall. Eventually, students are active agents of the food system in their thesis work by contributing to the sustainable food systems’ knowledge bank. Salomonsson et al. (2004) consider *action research in learning* a change from the conventional university learning paradigm to one where faculty and students learn through practical applications of experiential activities. Reason and Bradbury (2006) define action research as a participatory evolving process of acquiring knowledge. The outcome of action research ideally has practical value for the community or people, and at a larger scale contributes to decreasing inequality and negative consequences of human actions on nature.

Sterling (2001) states, “Sustainable education is only likely to emerge if it can connect with and draw strength from positive cultural change in the wider social context” (p. 23). Action learning, therefore, is an appropriate methodology for ESD, as it involves the community and allows students to contribute to society. Agroecology students at UMB partake in case work throughout Norway in the first semester, hired by municipalities to analyse steps towards sustainability. Students engage the local community in participatory workshops, and incorporate the information into their final report.

In open-ended learning, the end result is not determined. Students and teachers venture on a journey together, and unlike the traditional setting, the teacher, or facilitator, does not have a list of specific knowledge to be acquired. Rather, it is the application of different tools, methods and ideas to the situations the students meet in their case work and in their own personal reflection of their learning that determine the learning outcome. The experience plays an important part, and experience is always subjective (Glaserfeld 1995). Therefore, the learning for each individual student will vary.

In a summary of schools practicing sustainable education, Symons (2008) found that a factor leading to success is the opportunity for students to partake in decision making. Students feel valued and their opinions matter, contributing to shaping their education. Another key factor which is relevant to the case of agroecology is the students’ involvement in the community, learning through action, and the results of learning contributing to realising tangible steps towards sustainability in an existing rather than a hypothetical case.

The learning goals of the agroecology programme are listed in table 1. Summed up, teachers of agroecology at UMB attempt for the programme to be transferable, effect life-long learning, and for students to become reflective thinkers, while also empowering students with knowledge of sustainable food systems.

**Table 1 Learning goals of the agroecology programme at UMB**

**General learning goals**

- Have a knowledge of farming and food systems.
- Have the ability to handle complexity and change.
- Be good communicators and facilitators.
- Be autonomous and lifelong learners
- Have the ability to link theory to real-life situations.

**Knowledge goals**

- Agroecosystem/food system structure and functioning.
- Methods for dealing with complex issues in agriculture and the wider food system, including systems analysis and assessment of overall system sustainability.
- Specific features of ecological agriculture (organic farming).

**Skills goals**

- Teamwork.
- Communication.
- Autonomous, life-long learning (learning how to learn.)
- Action competence: how to manage complexity and change, bridge the gap between knowing and doing, transform knowledge into action and link theory to practical situations.

**Attitude goals**

- Learning to deal with ethics and personal and cultural values.
- Personal attitude qualities such as being open-minded, critical, determined, approachable, explorative and communicative.

In this study, the following research questions are examined:

1. What skills, knowledge and tools presented during the MSc course are former agroecology students able to transfer to the working life?
2. How successful are former agroecology students at linking theory and practice in their present profession/working life?
3. How effective do former students of agroecology see phenomenon-based and action oriented learning as learning tools for tackling sustainability issues in the food system?
4. To what extent does motivation matter as a driving force for students' satisfaction and personal empowerment in their agroecology education?

5. How do former students of agroecology see the agroecologist as an agent of change and how do they view the identity of the agroecologist?

## Methodology

The case study was chosen as the research method as it was deemed the most appropriate for examining the current conditions of former agroecology students. This is an empirical investigation which allows for in depth understanding of a phenomenon and the circumstances surrounding it. Yin (2009) defines three conditions when a case study can be used; to study phenomena in a real-life context, when little control of behavioural events is required, and when *how* and *why* research questions are asked.

Graduate students of the Agroecology programme at UMB were interviewed to gain insight into how effective education methods adhering to ESD are at empowering student to contribute to sustainable development. Semi-structured interviews were conducted. Research topics were defined and questions composed beforehand. However, in a phenomenological study, research questions arise in the duration of the study (Rudestam and Newton, 2007). Therefore, the interviews were structured to allow for flexibility and further questions. A trial run was made with a former agroecology student for adjustment of interview structure. See Appendix 1 for the interview guide. The participants did not receive a copy of questions beforehand, and were told that no preparation on their behalf was necessary in order to allow for more spontaneous answers. While the programme incorporates many of the elements of ESD, students are not necessarily aware of the concept. However, they are aware of the theory and goals of teaching and learning methods such as Kolb's learning, action learning and systems thinking.

Five graduated Agroecology students from UMB were interviewed, this small number allowing for in-depth analysis of each particular participant, while also permitting comparisons across variables such as educational background, motivation and field of work. Participants were selected based on three criteria; graduation year, educational background, and gender. Since a goal of this study is to discover which ways former students use the tools and knowledge from agroecology in their jobs, it was desired for participants to have graduated several years ago, in order for them to have established themselves in the work force to allow for the concepts, tools, skills and knowledge to ferment. No students who had graduated within the last 3 years were contacted. The participants had been students between

2003 and 2009. To reflect the low male participation in the class, only one of the five participants were male. Participants were also chosen based on their previous academic backgrounds. The backgrounds which are common of Agroecology students were chosen in order to look for differences in ability of meeting the learning goals, depending on the background and field of interest of the student.

### **Background of participants**

Note: The names and some personal details of the participants have been changed to ensure their anonymity.

**Hilda** has a background in agriculture. She has spent several years working with agricultural extension and development, before she took the master's in Agroecology. She now works as a farmer. **Janet** has a background in social anthropology, and has spent the years since graduation working for a humanitarian not-for-profit organisation. **Hans** has a background in agriculture and natural science, and works as a teacher. **Maria** has a background in economics and works for a not-for-profit organisation focusing on raising environmental awareness. **Barbara** has a bachelor's degree in sociology and works with national politics in her home country.

Interviews were conducted in early June 2012, and lasted from 45-60 minutes and the recorded interviews were transcribed afterwards. *Meaning condensation*, described by Kvale and Brinkmann (2009) was the main method of interview analysis. The authors describe it as an interview analysis method where longer formulations are reduced to shorter statements, capturing the essence of the statement, without necessarily turning data into quantitative terms (ibid.). The meaning units of statements were recognised, and the themes of these units identified. These themes were then tied back to the purpose of the study, categorised and examined in light of the literature.

At the end of the interview, the participants were asked to fill out a short survey examining their perception of to what extent the class was designed to meet the goals. These ratings were done in writing rather than orally in order to allow for more ease of thinking for the participants. The participants were asked to rate the goals with scores of 1 – 5, indicating to what extent the course was laid out to meet these goals. See appendix 2 for the learning goals survey.

## Results/discussion

In the following section, relevant parts of the primary data are presented with their interpretations. The research question relating to each section is noted.

### 1. WHAT SKILLS, KNOWLEDGE AND TOOLS PRESENTED DURING THE MSc COURSE ARE FORMER AGROECOLOGY STUDENTS ABLE TO TRANSFER TO THE WORKING LIFE?

The participants were asked what the value of the degree was to them. Maria mentioned the facilitation tools she learnt, such as running a café dialogue and a visioning seminar were useful in her job. Janet saw the value in the emphasis on creative and critical thinking and questioning the established truths. She gained from learning about different learning styles, and examining one's own learning process, as well as gaining thematic knowledge about the food system and its functioning. For Hans, the value of the course was its methodology, rather than specific topics of Agroecology. He stated;

I thought it was valuable to have the first semester with the courses we had, because it represented something different than what I had been through earlier in university. And I thought it was good that they focused on method... I think it was very valuable, to be critical to the glasses you wear, that you don't become narrow minded.

He benefited from the unconventional structure of the master's programme and the introductory course's teaching methods, its critical examination of the research paradigms, and the emphasis on reflection on learning. He had, however, initially sought the agroecology degree to gain more knowledge in agronomy. Hilda, who had a thesis in mind before she started the Agroecology degree, valued that she was able to carry out this thesis work. Likewise, Barbara valued her thesis work; "I felt that I managed to write a thesis that didn't just collect dust afterwards, but whose results mattered a little." Barbara worked with a humanitarian organisation for her thesis, and stated,

I am happy that I was able to cultivate some things from my own interests at the same time as I could contribute to someone else being able to gain from what I contributed.

Participants emphasised different values; the recognition of the degree, the thesis work, learning methodology, critically examination of issues, and the food system functioning. The values are summed up in **Feil! Fant ikke referansekilden..** Only one commented on specifically food system related themes. The value of the degree is mostly the methodical rather than thematic exposure, which are non-specific transferable skills and tools.

**Table 2: The personal value of the Agroecology master's degree**

Learning methods

- Reflecting on one's learning process
- Different learning styles
- Exposure to different learning and teaching methods

Thinking patterns

- Questioning the established truth
- Critically examining the research paradigms
- The emphasis on creative and critical thinking

Thematic areas

- How the food system works

Results

- Useful thesis results
- Cultivating one's interests
- The recognition of having a master's degree from UMB
- Thesis research
- Job related skills

The five participants have not experienced similar practical situations as the case work of their PAE 302 course, but have found several of the skills useful, such as writing client documents, participative methods, the ability to ask important questions and the relevance of the perspective of an external person. To these former students, the case work in itself was a medium to which they applied the tools and learning methods. Several components of the course are used in their current working lives, despite being distanced from Agroecology. Hans distinguished between field specific theoretical knowledge and field specific knowledge of methods. He felt he gained more knowledge about methods, such as learning, presenting, and systems thinking, but wished for more theoretical knowledge on agroecosystems, in particular what constitutes sustainable food practices.

Hilda stated, "I can't find the limit of where the course is and where my past is, because I would say it's all mixed." To Hilda, degree seemed to be a continuation of her previous work situation, where she worked as an extension officer in agriculture and development. Several factors contributed to the similarity with the job situation. She explained that there was not a set curriculum the students were expected to know and compared it to a job, where the outcome is unknown. Furthermore, she gained in areas that were useful in the work situations she encountered afterwards. She explained that the course

...develops a lot of our attitudes. It has communication and teamwork, it is not very individualistic. It focuses inwards and outwards, because we go out and we work with clients and not just colleagues...It justified something more than just a normal course, me sitting here and the teacher there, feeding each other. The teacher feeds me knowledge then I put it back in a paper. It was not like that, there was more interaction, like the real world.

Hilda emphasised the teacher/student interaction as positive. Since students are not seen as subjects of learning, but rather as active learners who partake in the curriculum, the value of the education may increase, highlighting the importance of curriculum empowerment and determination in agroecology, as will be examined in section three of the discussion.

Barbara's critique went to the lack of interdisciplinary of the course, that it was interdisciplinary with agronomy and natural science, but lacking on the social side. Barbara said, when speaking of her criticism;

I felt there was space for bringing that forth, and there was space for them to make adjustments underway. This is a completely different situation from my other university experience, that critique actually gets through.

Barbara was able to influence the course by introducing a theme she felt was lacking when considering the sustainability in the systems analysis. She brought her previous experience and knowledge to the table, and contributed to not only her own education path, but introduced a new theme to her colleagues. It may also have contributed further knowledge to the teachers, and demonstrates that value lies not just with experts. Providing student with the opportunity to influence the direction also gives them a better chance to question and analyse the content and learning methods. This awareness may contribute to a higher level of learning.

Barbara and Hans were both disappointed with their case work, because they did not feel they were able to write good enough reports for their clients. Barbara felt they did not go far enough and did not achieve what they had hoped. Hans specifically felt difficulty with the farmer's report, as he felt the group lacked general knowledge of agronomy, and that the group was incompetent to give agronomic advice to a farmer. Nevertheless, he mentioned, working on the assignment itself was part of the learning process. Barbara and Hans' disappointment are encouraging as it demonstrates integrity for the work which goes beyond their personal gain. However, it may also signify that they were unable to utilise their knowledge and strengths, and that a fundamental knowledge of organic agriculture was missing amongst the students. Facilitators of the agroecology programme should consider whether knowledge of organic farming should be a prerequisite for admission.

## 2. HOW SUCCESSFUL ARE FORMER AGROECOLOGY STUDENTS AT LINKING THEORY AND PRACTICE IN THEIR PRESENT PROFESSION/WORKING LIVES?

In this section, research questions relating to education *for* sustainability are covered, particularly what elements of sustainability are included in the education, and how former



students are able to link theory and practice. That many graduated students in general do not work directly with their field of study was reflected in the five participant of the study. Due to the interdisciplinary nature of agroecology, there are various appropriate jobs for agroecologists. Agroecology is a field still in development. Its identity may not yet have been set, and combined with the interdisciplinary of agroecology, the job prospects of agroecologists is not clear cut. Hans described his outlook on appropriate jobs after graduation:

Generally, I missed that the study was not really made for a practical job. I was very insecure when I finished, what I can work with now? Can I only work in an organization that believes things, or can you work in research, if you have the right agronomic background? I was a little unsure where I could work and if I had the right skills. The education could be a little more practical. It is practical, but I feel it could have been clearer what kind of jobs you might use it in.

This quote points to the perception of the work force requiring specialisation and the hesitancy at the value of other non-specialised skills and tools. Uncertainty of one's capabilities may be connected with the weak agroecology identity as the term *agroecology* may be misleading by pointing towards agronomy instead of referring to sustainable food systems, which is explored in section five.

When asked about how she felt about not working directly with the food system, Janet stated;

In that respect, [the degree] isn't relevant, but I don't feel that matters, for me there wasn't any concrete learning, so the theme wasn't that important for me. It was more about the learning processes and reflection processes and group dynamics, that's what I gained. Themes weren't so important, I have never used them.

Janet has not worked with sustainable food issues and has therefore not been able to apply thematic knowledge. However, she has used some of the transferable tools and knowledge on learning in human rights related work.

The following list reflects the elements that stand out the most for the participant's after the introductory course PAE 302. Common amongst them is their transferability as tools and skills which can be used in sustainability issues which are not only related to the agroecosystem. The listed components concern personal development and learning skills and tools. No agroecosystem specific concepts are on the list. Since the students did not necessarily anticipate the unconventional learning styles, this may be what stands out to them. The participants without agricultural background have found use for the agricultural knowledge they gained through the course in their work, even though they do not work

directly with agriculture. Barbara, for instance, who did not have a background in agriculture, found much use in an earlier job for the agricultural knowledge she gained during the course. Hans, who had an agricultural background, found the agricultural side to be lacking. Barbara and Hilda have also used the methods for looking at opportunities of the conditions surrounding an issue, introduced in PAE 302 (Swot analysis- Strengths Weaknesses Opportunities Threats). Hilda, for instance, used the Swot analysis with layman's terminology when writing a report about green care farming. Hans used rich pictures when teaching students about farming systems. This allowed him to demonstrate the ways parts are connected, rather than reducing the system to parts. He has also applied reflection sessions on the students' learning process and sees the importance of designating time for reflection sessions on learning.

**Table 3 Summary of what stands out most to participant after the introductory agroecology course PAE 302**

- learning cycle
- visioning seminar
- writing documents
- group work and dynamics
- how to reflect over one's own learning process
- systems thinking
- understanding different sides of an argument

Maria stated that she has used tools, rather than thematic knowledge in her working life, however, she has used knowledge about sustainable food systems at a personal level. She refers again to her main goals of starting the agroecology programme, of systems thinking and participatory methods.

What I've used the most are the tools, facilitation tools, how to organise groups in idea-workshop type models, café dialogue and visioning seminar... this is what has been an active part of my life afterwards, because I have used it in my job.

Janet feels that the philosophy of participatory learning is useful in her work. After graduating, she has even gone back to reread some of the articles from PAE302 on participatory learning which she used in a work related document. The idea of participatory learning is what she transferred with her to her field. Although she does not work directly with the food system, she sees relevance of concepts learnt: awareness of the learning processes, reflection processes and group dynamics, rather than agricultural themes. She also learnt about writing documents- but, she states, "we did it and that's how we learnt it, we

received no training in it, so I learned through writing.” Unknowingly, Janet demonstrates how she practiced experiential learning. Though Janet learnt from the writing experience, she does not see it as valuable as had she been given a lesson on how to write.

The participants demonstrate how tools were used in the educational setting and in the work setting. These transferable, non-specific tools have proven to be the most useful elements, rather than thematic areas. Elements used in their working lives are summed up in the following list:

#### **Table 4 Summary of elements used in working lives**

- Swot analysis (with layman’s terms)
- facilitation tools
- café dialogue
- visioning seminars
- writing documents for clients
- participatory learning
- rich picturing
- themes from guest lectures

Some of the participants see the thesis work as being a potential stepping stone into the work life. The thesis work was frequently brought up when asked what they would have done differently were they to do the masters again. Maria mentioned its relevance; she wishes she had conducted a thesis which was more relevant to her job. Hans also commented on his thesis work, but wished it were connected to a larger project, in order to ensure the usefulness of the thesis. Hans would have liked to participate in a research project for his thesis, and wished for more theses projects suggested by the institute. Janet felt unprepared for the thesis work, and wished for more guidelines. This is in contrast with the programme’s aim for open-endedness, which Janet noted.

### **3. HOW EFFECTIVE DO FORMER STUDENTS OF AGROECOLOGY SEE PHENOMENON-BASED AND ACTION ORIENTED LEARNING AS LEARNING TOOLS FOR TACKLING SUSTAINABILITY ISSUES IN THE FOOD SYSTEM?**

The following section discusses learning methods which can be applied in ESD, and how effective former students see them. Agroecology professors at UMB aim for agroecologists to be lifelong learners. The continuous process of lifelong learning allows for flexibility and adaptability in future situations. As well as having value in the workplace, learning should be personally transformative. Since awareness of learning and being a lifelong learner is essential

for being an agent of change in the future of the food system, a large part of the initial agroecology semester is centred on the learning abilities of the students, including theoretical and practical applications of the concepts.

Some of the participants wished to have gained clearer guidelines on what constitutes sustainable food production, and felt there was too much focus on the learning processes. When asked of their initial experience of the introductory course, key words mentioned were primarily related to the pedagogical method of the class. The participants mentioned the methodology and learning more than thematic areas of the food system, such as sustainability, organic agriculture, and nutrition. Barbara stated,

It is clear that they work with pedagogy not just for teaching, but pedagogy as a tool that the students should learn as a part of the development of the agroecology field.

Experiential learning, transformative learning, autonomous learning, and lifelong learning are part of becoming an agroecologist, and potentially for one's education to be sustainable.

Hilda saw the class as giving the foundation for "learning how to learn," and found it possible to apply this in her other classes. Though most of her other classes did not emphasise experiential learning, she felt the introduction she had received on learning could be utilised. She was capable of applying the learning skills in the classes which followed the traditional university setting. Here Hilda demonstrated her skills as an autonomous or lifelong learner; she applied previously learned skills in a new class, which she had not been asked to do. Hilda saw the introductory course as based on learning and empowering students in their own learning. She emphasised that it was difficult to test students on the material in the class and its value transferred over to other classes.

Curriculum empowerment and determination is a desired concept in the ecological view of the management of the learning environment (Sterling 2001). Agroecology students at UMB are in part in control of their own curriculum after the course PAE 302 in the first semester by being able to choose courses and themes within agroecology themselves. In the following section, the participants' views of this process are expressed.

It may be a challenge for some students to shift from a setting with a mandatory class and a consistent group of colleagues, while upholding a sense of connectivity and agroecology identity throughout their work. Maria, who went abroad as an exchange student for the second semester, sees a clear link between her new courses and the initial semester. She also

considers her thesis work as covering a central theme of agroecology. However, she had trouble adjusting to the solitary setting of the thesis work, and wished for a more solid agroecology environment. Maria saw a thematic connection during her degree, but felt there was a lack of social connection which enabled her to share the writing and research process in an agroecology academic setting. Hans attempted to choose courses which related to the introductory semester, but found it difficult to create continuity because he felt a lack of course choice. He further continued to strive for continuity by including agroecology terms and methods in his thesis. He wished for a better understanding of the courses and their connection to agroecology, before stating them.

Hilda and Barbara both had theses in mind when venturing out on their degree. Therefore, it may have been easier for them to build continuity than for Janet who did not have a clear idea of a research area. Barbara had further goals for her thesis which was a driving power, and appreciated the chance to write a thesis which counted as more than a requirement for the completion of a degree.

There is a variable appreciation of the openness of the course. All but one participant appreciated the openness of the programme and the students' opportunity to choose courses. Janet, however, stated;

I remember we talked about the mixture of chaos and control, and that the teachers were very occupied with letting students out into chaos, that one should figure things out by oneself, but I felt that it crossed the line regarding how much chaos is healthy, or that gives maximum learning effect. So I think it was too open.

She believed the open semesters without mandatory classes were not a pedagogical strategy but rather arranged due to lack of resources. To Janet, a direction should be embedded in a degree. She admitted that she wished she had been part of a more structured degree, but had been able to take the first Agroecology semester as well. Janet appreciated many elements of the initial agroecology degree, particularly those adhering to ESD (such as self-evaluation, critical and creative thinking, participation), but had trouble adjusting after the first semester. The introductory agroecology course, which is heavily laden with elements of ESD, serves as an introduction to sustainable learning, with the ambition that students carry with them these learning methods. The university does not have ESD as a guideline, therefore other courses students choose do not necessarily fall within this education paradigm. This is a weakness, and the whole school approach is one of the five key success factors in ESD as indicated by the WWF-UK consultant Gillian Symons (Symons, 2008).

In a society where the prevailing paradigm values factual knowledge above intuition and capability, learning may be seen as gaining knowledge of facts. Pedagogy adhering to the principles of ESD, in the case of Agroecology at UMB, is unconventional and differs from the common methods. Not every student appreciated the methods, as exemplified by Janet who did not consider learning through doing as learning. Janet stated,

I don't feel that I gained any knowledge, it was tools I gained, I remember well, for instance, the learning cycle, the different learning styles people have, how we learn, learning to conceptualise, basically practical learning, I remember that well. It was perhaps a little concrete, but it was more about how to learn... then I learnt to a certain extent how to write documents, but that was something we *did* therefore we learnt it, we did not get any training in it. Then I learnt through writing the assignments about organic agriculture. But maybe what I gained is that we had so much group work and how a groups work, and how to reflect over one's own learning process.

In this quote, she demonstrates that she gained knowledge about learning styles and working in teams, but she did not consider this knowledge, since it was not factual. There may be a hint that learning through doing rather than through instruction is less valuable. She further states that "I had expected something different, more focus, more concrete learning, but there was no concrete learning at all." Despite her expectations of an education setting following the mechanistic view, and despite her disappointment with the thematic coverage, she was overall pleased with the methods and what she gained. This sentiment was brought up by other participants too. Hans, likewise, expected more focus on practical agronomy rather than the theory on the methods of advising, instructing, analysis, and observation. Janet saw a focus on methods of learning, reflection and working in groups, which are not necessarily Agroecology-dependent skills.

Maria was pleasantly surprised by the practical case studies, and the divergence from the regular university lecture model. She expected a continuation in the methods applied in her bachelor education. Hilda had a vague understanding of the teaching methods and course content when she applied, as she had known a previous student. However, Janet had also heard of the course through a former student, but did not have a clear understanding of the course, as the divergence from her expectations shows. Knowing a former student may not necessarily ensure an understanding of the programme. This may be due to differences in Janet and her acquaintance's learning strategies. Is it necessary to be an autonomous learner before starting the programme, or is it possible to gain this skill during the programme?

Maria heard a lot of complaining during the introductory course, but afterwards, she saw the benefits. This comment has occurred many times after completion of the course by other students. This may be the nature of open ended studies; the end result is not clear, and the end result of learning differs for each student. As the course is set up now, the students must put their faith in the programme, and although during the course the end result and benefits may be murky, they must believe they will gain an enriched learning experience.

Students are presented with the learning goals at the start of the degree. The goals provide an indication of the purpose of the methods applied in the initial semester, and what tools, skills and knowledge an agroecology student is expected to have gained. Examining the extent to which students felt these goals were met, sheds light upon how successful the pedagogical methods and activities are, and whether students of the programme can realistically be expected to gain the skills, tools and knowledge in order to contribute to sustainable development in the food systems.

The goals include gaining knowledge of thematic areas of the food system, tools for tackling food system related issues, and gaining transformative skills and attitudes. Table 5 shows the participants' scoring of the extent to which learning goals were met in the initial agroecology semester, sorted according to ranking. The highest scoring goals were teamwork, communication, autonomous, lifelong learning, and personal attitude qualities, three of these being skills goals. Students receive practice in the skills goals through group work, during reflection while composing the learner's document and reflection seminars. These are skills students are exposed to through their practical case work, but which also is supplemented by the theory on learning.

The lowest scoring goals were the knowledge goals, particularly *specific features of organic farming*. Two other food-system and agriculture specific goals, methods for dealing with complex issues in agriculture, and agroecosystem/food system structure and functioning, also scored low. It appears that those goals which are transferable, non-specific to agroecology, and can be used in other fields, are the ones the course is most successful in meeting. The low score of *specific features of organic farming* can be exemplified by Hans' comment;

There could have been more practical things. We had some external presenters who had more concrete practical things to talk about, we could have used more time to learn what exactly sustainable food is, we use the term all the time, but one needs some knowledge about what it is, for organic food is not synonymous with

sustainable. Find out what is good and what is bad, that we learn more about what affects the environment, and what is good and bad in agriculture.

Hans believed he would have gained more awareness of sustainability issues in the food system through more factual knowledge on theoretical aspects of organic farming.

**Table 5 Participants' scoring of the extent to which learning goals were reached in the introductory agroecology semester**

Rank	Goal	Score (out of 25)
1	Teamwork (skills)	23
2	Communication (skills)	22
3	Autonomous, lifelong learning (learning how to learn) (skills and general learning)	21
4	Personal attitude qualities, such as being open-minded, critical, determined, approachable, explorative, and communicative (attitude)	20
5	Action competence: how to handle complexity and change, bridge the gap between knowing and doing, transforming knowledge into action and link theory to practical situations (skills)	19
5	Learning to deal with ethics and personal and cultural values (attitude)	19
5	Have the ability to link theory to real life situations (general learning)	19
5	Have a knowledge of farming and food systems (general learning)	19
5	Have the ability to handle complex situations (general learning)	19
5	Be good communicators and facilitators (general learning)	19
6	Agroecosystem/food system structure and functioning (knowledge)	18
6	Methods for dealing with complex issues in agriculture and the wider food system, including systems analysis and assessment of overall system sustainability (knowledge)	18
7	Specific features of organic farming (knowledge)	17

#### 4. TO WHAT EXTENT DOES MOTIVATION MATTER AS A DRIVING FORCE FOR STUDENTS' SATISFACTION AND PERSONAL EMPOWERMENT IN THEIR AGROECOLOGY EDUCATION?

In correspondence with the necessity of personal engagement in ESD, the motivation of each participant was examined, in order to assess the link of personal engagement with ownership of learning and satisfaction. Themes which appealed to former students when they applied for the programme were: the connection between organic agriculture and society, how society relates to the food system, and a desire to learn more about the agricultural perspective of food. Maria, however, was drawn to the general idea of systems thinking:



...in my bachelor, when I worked with very big issues, it became frustrating with time. Then I read about systems thinking and about learning tools for tackling large, complicated issues. So I wasn't interested in agriculture, although I had it in my bachelor, but it wasn't really the reason why I started, more as a method of using agriculture to practice systems thinking tools and tackle big issues.

Maria saw systems thinking as transferable and not specifically relating to agroecosystems. She started out without an academic interested in food. During her bachelor's degree, she got fed up with school. Coming from a rigid discipline, she looked for a master's degree which allowed for divulgence into subjects of a personal interest. As the only participant who noted the job perspective as a motivating factor in the application for Agroecology, she explained that

I acknowledged that if I wanted to work with something more enjoyable then I needed a master's degree, because there were no good jobs to get with a bachelor's degree... I was still not ready to go back to school, I was still tired of school, so it was about finding a programme that I could get through without burning out again... So I chose to do something fun, something I thought was just interesting and enjoyable to study and then maybe take a little longer to get that job I want.

Throughout the interview, she frequently used words such as "fun" and "amusing" to describe the programme, which are not usually connected to school. This participant exemplifies the level of personal involvement which may be more so present in agroecology than some other fields, possibly due to food being personally relatable for everyone. Likewise, the subject of sustainability is also relatable, as the study of the food system forced Maria to examine her own life and choices:

I use the knowledge of food a lot. It has maybe affected me more at the private level because I don't work specifically with food now.

The critical question is whether Maria learnt, or whether she just had fun. In a learning situation which may be perceived as fun, it is important that the learner is able to reflecting on the learning situation, and not overlook the lesson. Particularly in field lessons, distractions from learning may appear. Hans noted the importance of the teacher setting aside time for reflection for students new to this process, which students may continue to do on their own accord after repeated sessions initiated by the teacher.

The motivation for Hans and Janet was a basic interest in agriculture. Hans and Janet had higher expectations of acquiring factual knowledge than the other three participants. Their goals were expressed more vaguely than the other participants, and they are also the two

participants who conveyed more dissatisfaction with the programme. Janet and Hans were both more oriented on agronomy in their expectations.

Barbara and Hilda had clear theses in mind and found Agroecology to be an appropriate degree to accommodate the thesis. Barbara came from a social science background, and searched for an interdisciplinary programme which allowed her to combine social and natural sciences in her thesis. Barbara showed a personal motivation for her own learning, demonstrated in this quote:

The master's degree is a period where you are allowed to be very egoistical. I had a period where I could cultivate some of my interests very intensively and be able to steer the direction myself. And that is a luxury you can't do necessarily for your whole life.

From these cases, four categories of motivation for starting the Agroecology programme are identified; (a) a means of carrying out a pre-conceived master's thesis (b) in order to study the specific themes of Agroecology, (c) a way of carrying out systems thinking methods and (d) a way of achieving a more enjoyable job. Some of the participants expressed stronger motivation, based on their personal goals for their own development and contribution to the sustainable development of the food system. The case of Hilda and Barbara shows that students who had a stronger motivation also gained more satisfaction from the programme, reflecting the importance of a high personal incentive.

##### 5. HOW DO FORMER STUDENTS OF AGROECOLOGY SEE THE AGROECOLOGIST AS AN AGENT OF CHANGE AND HOW DO THEY VIEW THE IDENTITY OF THE AGROECOLOGIST?

The misconception of the Agroecology programme as an agronomic or horticultural master's programme is common. This may be, as Hans stated, partially due to the name and its complicated definition, and which few are aware of. The name of the introductory course PAE 302 was changed in order to reflect the students' perception of the course better. The definition of Agroecology is not widely known or inherent, as the many misconceptions show. There is a lack of a strong, recognisable identity of the agroecologist, a topic which was mentioned by several participants as having an effect while conducting the thesis work and open semesters, and finding their place after completion of the degree. Several of the participants found the lack of an agroecology unity disappointing when conducting thesis work.

It is a goal for students of agroecology to be empowered with tools to change the current situation of the food system, often called “agents of change.” When asked what an agent of change was, the participants gave five different answers, and some actively attempt to possess this role. The phrase “new solutions” was common amongst the answers, but each participant interpreted the definition differently, answers reflecting their personal experience and values. Hilda, for instance, has worked extensively with participatory research, and for her, the method of participatory action is an important element of the change agent. Maria has worked with promoting sustainable action and sees an agent of change as someone who facilitates the practical application of environmentally sound actions.

Participants mentioned several components of the course which they felt led students towards becoming agents of change. Janet sees the visioning seminars as useful tools for agents of change. She sees importance in daring to strive for a future very different from the current situation. However, she stated that she does not feel that she is an agent of change. Hans sees an agent of change to be “...capable of trying new things, be innovative, look outside the box, to use existing knowledge while daring to use new knowledge.” Though not stated explicitly, Hans’ thoughts are in line with transformative learning, which involves changing one’s actions after reflection, and a change in how one sees one’s worldview. About the course encouraging him to be an agent of change, he stated:

I feel that we got the chance to try out some different methods of getting there. Reflecting on what you have done, to redo things in an improved way, there was focus on that. But if I should relate it to agriculture, which is my field, then I felt there was little, it was about what knowledge you had from before.

Barbara sees an agent of change as someone who is able to use their academic knowledge in effecting change. These are scholars who feel a responsibility of letting “knowledge materialise in action,” to bridge the gap between knowledge and action. She sees that in the traditional university setting, students are trained as observers rather than participants. However, her view of what an academic or a researcher can contribute to society was changed by the programme. Participation within the issue one is studying is essential for being an agent of change, she continued.

I think it’s great that there are some studies that take that perspective, because the idea that as a scholar you can sit on the side of society is completely pointless, because you will always be a part of society, you will always carry your own perspectives when you enter a situation and analyse it.

Hilda felt that through experiential learning, students were empowered to use the tools of an agent of change. She described the following example:

I think it is going to society... For example we come to a village, and this is the village right now, and we think about improving the situation for the people in the village; better income, better happiness, better food. We have some ideas, we get information, with the help of methods from agroecology; reflection, reflecting on learning, experiential learning. We learn, and also try to show the people the situation. We have an idea but we can't change other people just with ideas, changing attitudes is a huge thing. But we have the possibility of visualising and showing them their situation and show some options. So this course has something huge, and empowers the students to use this tool.

She further compared it to job training. According to her, this was a capacity building tool, useful for a position in the working life where being an agent of change is a goal. Similarly, Maria drew a comparison of agent of change to her work experience, and stated,

That's what my job is... We help people make more environmentally friendly decisions, help change behaviour patterns.

As part of her job, she attempts to be an agent of change by changing actions and attitudes, and found use of the facilitation tools.

Barbara pointed out that the role of agent of change is a demanding role, and believes it is difficult to be a singular agent of change, and emphasised the need for organisation. This is represented in the responses of the participants; Maria demonstrated most clearly how she is an agent of change, and is the only one whose workplace has as a goal to be an agent of change, though not explicitly called that. Barbara commented on the programme empowering students to become agents of change:

I am not sure if the course in itself will function that way for everyone, because to take on the role as an agent of change is demanding, and it demands a different and larger perspective, and it also demands that one has someone to stand with ... It isn't given that one can do it, and it isn't given that your degree gets you into a job that has the same goals.

It is not a certainty that one can become an agent of change by studying sustainability issues. The participants demonstrated different levels of interest in being active agents of change. Taking on the role is challenging and requires a proactive assertiveness. This is in line with the ecological paradigm of the active learning style, critical and creative inquiry. Following her comment on the importance of organisation for agents of change, Barbara mentioned that "maybe one will be a stronger agent of change if there is a sense of unity at the end of the

degree.” It can be concluded that a stronger sense of identity as an agroecologist and hence an agent of change can be created by more unity with fellow agroecologists. The next step for strengthening this identity is to explicitly be linked to the larger movement of the ecological paradigm and ESD.

## **Conclusion**

This case study examined the effectiveness of the UMB agroecology master’s programme at providing students with tools, skills and knowledge to participate in the sustainable development of food systems. Though most of the participants do not work directly with food systems, they demonstrated a high level of transferability of tools, skills and knowledge from the agroecology master’s degree in sustainability fields. Participants have, to varying degrees, continued to apply learning methods. The teachers have been successful in providing a learning environment for experiential lifelong learning, though with varying results.

It is clear from the case study that all students do not automatically become autonomous learners. Some of the participants thrived as autonomous learners in the openness of the programme, while others saw it as more damaging to their learning than valuable. The participants from the survey can be divided into two categories regarding learning strategy. The participants are either autonomous, take control of their own learning, and use the university as a resource through their own initiative, or seek a university degree as a way of guidance to the future, and see the professors and the institute as leading them in a direction which is unclear to the student beforehand. The programme should take into consideration the specific needs of these two types of students, which means accommodating for autonomous thesis work and course choice, while also allowing for more structured guidelines.

The initial motivation for studying agroecology were primarily thematic areas related to food system functioning or agriculture. However, the skills and knowledge the participants gained from the programme were primarily related to lifelong learning and transferable systems analysis methods. The agroecology programme empowers students for participatory research, though not necessarily within the food system.

In their reflections, some of the participants showed adherence to the conventional paradigm and did not see the value in phenomenon based learning, for instance in their belief that a

formal lecture would have provided more knowledge than experience itself. The effectiveness of phenomenon based learning may vary amongst students, but its effectiveness is also likely affected by the common perception of how formal education should be conducted. The participants' rating of the learning goals reflects the intention that students delve into thematic areas in their second and third semesters, while the initial semester provides the foundation for lifelong learning methods.

The thesis work was the main area of concern raised by the participants. In general, the participants expressed a desire for their thesis work to be valuable for society or for their post-education work. Several participants mentioned the desire to be part of a larger research project. However, participants enjoyed the freedom of choosing the topic freely within the realms of agroecology. In the future, it may be productive to make research projects for thesis participation more accessible to students, while emphasising the other possibility of independent research work.

A long term goal for agroecology professors worldwide should be to strengthen the agroecologist's identity. This could be done by aiming for more visible contributions to student read journals to increase the common knowledge of agroecology and potentially to draw more candidates encourage submission of thesis work not just to academic journals but to popular science media such as newspapers, and to create a solid agroecology network through social media.

Two weaknesses of agroecology as a graduate programme implementing ESD came forth; the lack of whole school involvement with a teaching strategy aimed at sustainable development and the lack of a clear agroecology identity. Sustainability is not necessarily part of the curriculum of other courses nor are learning methods necessarily participatory, phenomenon-based, or encouraging lifelong learning. Currently, agroecology students are exposed to learning methods within the ESD framework in the initial semester, and it is up the student to continue these methods in the further semesters. Some students may be more inclined to autonomous learning than others, as was demonstrated by participants in this study. It cannot be expected that students continue higher order learning unless encouraged by a teacher. The likelihood of students in agroecology becoming successful practitioners of sustainable development and lifelong learners would undoubtedly be increased if the university embraced the characteristics of ESD as an educational strategy.

While the agroecology identity is not strong, ESD is gaining exposure and application in educational institutions. ESD provides a framework and a purpose for education in sustainability and for sustainable learning methods. The ecological education paradigm explained by Sterling (2001) provides a clear example of how the learning strategies described as methods of ESD, such as phenomenon-based, participatory and lifelong learning, are effective. Through the association to this world-wide strategy, and with a clearer understanding of its purpose and how it is linked to a global movement, students of agroecology may be able to see themselves as part of a sustainable development community, especially if linking agroecology to ESD occurs in other agroecology programmes as well. Identifying the association with this paradigm may strengthen the agroecologist's identity by recognising the agroecologist's role as a contributor to sustainable development. Greater exposure to the purpose of the learning strategies and their relation to the ESD umbrella, may provide students a momentum to carry with them further in their studies.

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# Appendices

## APPENDIX 1 INTERVIEW GUIDE

What was it that first drew you to the agroecology master's degree?

How did you experience the PAE 302 course?

Did the course meet your expectations? How was it different, both positive and negative?

Which themes or knowledge is it you remember the most after PAE 302?

Do you remember a situation from your job or in other decision making processes in your private life where you used this knowledge?

Have you experienced similar situations in your work as you did in your case work? How was it different?

A goal of the programme is to help students become "agents of change." What does this term mean to you?

Do you feel that the course prepared you to become an agent of change`?

When you think back on your master's degree, do you feel there was continuity throughout the semesters?

What do you feel intuitively was the value of the master's degree for you?

- What did you miss in the master's degree?
- What would you have done differently?
- What do you think should have been different?

Would you be where you are today without the Agroecology master's degree?

## APPENDIX 2 LEARNING GOALS SURVEY

To what extent do you feel the course prepared you to meet the following goals? Rate from a scale of 1-5 (1=poor 5= excellent)

<b>General learning goals</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<i>Have a knowledge of farming and food systems.</i>					
<i>Have the ability to handle complexity and change.</i>					
<i>Be good communicators and facilitators.</i>					
<i>Have the ability to link theory to real-life situations.</i>					
<b>Knowledge goals</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<i>Agroecosystem/food system structure and functioning.</i>					
<i>Methods for dealing with complex issues in agriculture and the wider food system, including systems analysis and assessment of overall system sustainability.</i>					
<i>Specific features of ecological agriculture (organic farming).</i>					
<b>Skills goals</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<i>Teamwork.</i>					
<i>Communication.</i>					
<i>Autonomous, life-long learning (learning how to learn.)</i>					
<i>Action competence: how to manage complexity and change, bridge the gap between knowing and doing, transform knowledge into action and link theory to practical situations.</i>					
<b>Attitude goals</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<i>Learning to deal with ethics and personal and cultural values.</i>					
<i>Personal attitude qualities such as being open-minded, critical, determined, approachable, explorative and communicative.</i>					