Agroecosystems Analysis from the Grass Roots: A Multidimensional Experiential Learning Course

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ABSTRACT

An intensive, experiential travel course in Agroecosystems Analysis was conducted in Iowa, Minnesota, and Nebraska during summers of 1998 and 1999. The intended student audience was advanced undergraduate and beginning graduate students. Pretravel readings and a week-long series of farm visits, which consisted of in-depth interviews with the farmers and their families, prepared student teams to analyze and evaluate the production, economic, environmental, and social sustainability of 10 farms. Students shared their analyses both orally and in written reports. Based on a multifaceted student evaluation process, we found that participants were highly motivated, strongly engaged with the course content and learning activities, and committed to learn from the interviews and group learning processes. They reported that this multidimensional learning experience was more valuable than other traditional courses at their home campuses. Faculty learned how to: (i) allow students the opportunity to assist in developing the learning environment and community; (ii) design an optimum travel schedule to permit adequate time for individual reflection and group process; (iii) deal with challenges in the small group setting; and (iv) design a useful multi­phased learning evaluation process. Based on this experience, faculty in Iowa, Minnesota, and Nebraska are highly motivated to continue this course and expand the opportunities for experiential learning.

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GROECOSYSTEMS ANALYSIS is a three-state collaborative field course that was initiated through the North Central Institute for Sustainable Systems (NCISS). This course utilizes visits to farms and other sites of significance, coupled with students’ reflections and analytical assessments of these farms and sites. The course is for seniors and beginning graduate students to learn from the interviews and group learning processes. They reported that this multidimensional learning experience was more valuable than other traditional courses at their home campuses. Faculty learned how to: (i) allow students the opportunity to assist in developing the learning environment and community; (ii) design an optimum travel schedule to permit adequate time for individual reflection and group process; (iii) deal with challenges in the small group setting; and (iv) design a useful multi­phased learning evaluation process. Based on this experience, faculty in Iowa, Minnesota, and Nebraska are highly motivated to continue this course and expand the opportunities for experiential learning.

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http://www.JNRRLSE.org
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677 S. Segoe Rd., Madison, WI 53711 USA

This paper summarizes our experiences over 2 yr (1998 and 1999) in offering an interinstitutional field course focused on agroecosystems analysis for undergraduate and beginning graduate students. Our purpose is to describe the course objectives, the specific elements of the course, and especially the approaches used to foster preflection and reflection, active learning, and team research, while highlighting student responses, outcomes, and our conclusions. Methods are given in detail because these may be useful to others planning short courses. We trust that others who undertake field-based educational ventures in agriculture, regardless of their disciplinary context, will find our experiences and conclusions helpful.

METHODS

Course objectives for Agroecosystems Analysis were to provide students with a first-hand, practical field experience with farms in the Midwest and with an opportunity to develop and execute an analytical construct for comparing farms and other elements of representative agroecosystems in our region. Specific outcomes for students who completed this course were to: (i) develop criteria for farm comparisons and for a strategy to collect needed information; (ii) conduct interviews and make observations to collect relevant information during farm visits; (iii) compare and contrast production, economic, environmental, and social characteristics of different farms; (iv) develop skills appropriate to small group processes and practice these skills in analyzing and evaluating the farm interview information; (v) integrate and understand the multiple goals of farm families and explore how these are being achieved; and (vi) practice oral and written communication skills in presenting results of farm analysis.

Background reading material was provided by each faculty member based on their experience with prior agroecology courses, relevance to systems thinking and farming systems design, and emphasis on multiple dimensions of farm functions and criteria for evaluation. Some articles and chapters were mailed to students at least 1 mo before the course. Additional materials were provided on site. Each faculty member brought a mini-collection of personal books to create a temporary, on-site library that provided students with references on sustainable practices, alternative farming systems design, and multicriteria evaluation methods. A partial list of these resources is given in Table 1.

Criteria for choice of farms were established by faculty before the start of the first course. We chose farms in a three-state area based on diversity in size of operation, potential to provide a cross-section of farms typical to the region, and goals of the farm families. The farms selected represented differing agroecosystems, landscapes, soil types, and topography. They also varied in distance to markets and marketing strategies. A disproportionate number of diversified, mixed farming operations were chosen to make comparisons more meaningful. At least two large and predominantly conventional corn–soybean \([\text{Zea mays} L.–\text{Glycine max} (L.) \text{ Merr.}]\) farms, representing the norm for the region, were selected each year. Local extension educators and personnel from farmer-based organizations provided advice and assistance on locating interesting and accessible farms, and contacting farmers who were open and articulate in describing their operations. Including farmers who would readily engage the students during interviews and other times of interaction was important. Whenever possible, we encouraged farmers to include other participating family members in the interview and visit.

In a series of conference calls, the faculty discussed prospective farms and how they would fit into a 1-wk schedule. Faculty in each state contacted farmers in their state and confirmed the schedule. Farmers received a modest honorarium, an important feature, for hosting the class, since the farmers served as the essential instructors for this course. Before the course, faculty contacted the farmers and discussed the broad goals for the course and the visit to their farms. Having visits that were not scripted beforehand was important and students were the ones who directed the questions to the farmers. However, farmers were told the kinds of questions that would likely be asked by the students during the interviews. Student recruitment was promoted by posting course objectives and schedule on university bulletin boards and on the North Central Institute for Sustainable Systems website, as well as through announcements in key classes during the spring semester. Most successful were individual discussions with interested students by faculty in each state. Advertising was primarily in agronomy courses, although students were attracted from other majors including general agriculture, horticulture, natural resources, environmental science, agricultural economics, and anthropology. One or more students
each year came from a private college in Minnesota, as well as the land-grant universities. In both years, the course included a balance between advanced undergraduates and beginning graduate students. For the second year (1999), testimonials and evaluation comments from first-year (1998) course participants were useful in the recruiting process.

Creating student teams of three or four students was done by faculty using background information about the students, plus their initial biographical presentations. Diverse teams were established with regard to gender, home university, major, and year in school. We included five teams, one each assigned to the broad themes of production, economics, environmental impacts, landscape integration, and social issues. A faculty advisor worked with each team, although all faculty were available to every team when their respective specialties were needed. Facilitators provided initial guidance to the teams, and from the start helped establish ownership and decision-making on the part of the students.

Course format during the 8 d began with students and faculty assembled the first afternoon to discuss course goals and logistical arrangements (Table 2). Initial hours were spent in developing a learning community. Each student and faculty member prepared a personal biography on site using large (60 by 80 cm) flip chart paper and colored markers. Some biographies were chronological outlines of life experiences, lists of activities in academia, and personal experiences relevant to the course. In 1- to 2-min presentations, students introduced themselves to the course’s learning community, described what experiences and resources they brought to the course, and summarized their expectations. This exercise was used to build rapport in a group generally unfamiliar with each other, to validate each student’s prior experience and academic preparation, as well as to establish the faculty and students as co-learners in the course. This exercise begins the process of creating a safe learning environment to assist students and faculty in finding comfort zones within and between teams. A guarded initial learning environment is critical to promoting education risk taken later in the process (Woods, 2001). A shared meal was followed by a team-building exercise in which each team planned and assembled a tower built of newspaper, masking tape, and string, using their own cooperative designs developed without any verbal communication. This exercise proved to be an engaging and highly symbolic one for helping students to understand the fundamental collaborative learning nature of the course. After debriefing the tower-building exercise, the faculty outlined the course schedule and activities. Student teams and facilitators met to begin designing interview questions in their respective dimensions of the farm analysis.

Each day the group visited two or three farms (or other significant sites). On average, travel time was about 90 min between sites. A significant problem during the first year of the course was overbooking the days with too many site visits. Time and low student energy in such situations limited the capability to adequately debrief and reflect upon the visits. Students did use travel time to develop camaraderie, discuss previous farm visits, refine the process for interviews, clarify new terms or questions from a previous visit—or sleep. Fatigue was definitely a factor as the week progressed, especially in the first year. Later in the week, student teams often chose to ride together to consolidate information and to work on their end-of-week presentations. Faculty used such times to ask questions, probe students’ perceptions and analysis of prior visits, and clarify doubts about farming systems, practices, and management. Faculty also used the time to read the sentiments of the group, assess learning, and contribute to the overall evaluation of the course.

In the evenings, we engaged students in a large group debriefing session about the day’s visits. As the week progressed the student teams met in the evenings to consolidate information from the farm visits, refine their questions for subsequent interviews, and establish criteria for cross-farm analysis and evaluation. Toward the end of the week, they planned for their final presentations and began to write component sections of their written team reports. Facilitators attended the early group meetings to assure that the learning process was progressing, and then prompted leadership to emerge so that students could set their own agendas and proceed on their own schedules. Faculty were available to all teams as consultants in their areas of expertise, and to contribute to the group process when needed.

Preparations for the final presentation became more intense as the scheduled time approached. Student teams worked late into the evenings as they consolidated their observations, decided on key criteria for evaluation, and planned the format for their presentations. We urged teams to make their oral reports highly participatory for the entire community, to find ways to gather additional information and insight from other teams, and to use the hour-long presentation as one way to test their ideas and gain additional perspectives on their interpretations of the farms. They were provided with overhead transparencies, flip chart paper, markers, and access to computer presentation software if needed. Creativity and participatory learning were both strongly encouraged.

A closing session was used to summarize the week’s learning activities, provide feedback on the oral presentations, and answer questions about the written report to be developed by each team. For this report, students were instructed to cover aspects of sustainability, not just their own area for the oral presentation, and were given 1 mo to interact with others in the group and share report drafts electronically to develop the final report.

<p>| Table 2. General schedule of daily activities for Agroecosystems Analysis course, 1998 and 1999. |</p>
<table>
<thead>
<tr>
<th>Day</th>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td>1600 h (4 p.m.)</td>
<td>Course introduction, community building, information resources, initial student team meetings</td>
</tr>
<tr>
<td>Day 2</td>
<td>0800 h (8 a.m.) evening</td>
<td>First day of farm visits, cultural activities, recap of visits, Student team meetings, refining interview questions</td>
</tr>
<tr>
<td>Day 3</td>
<td>morning</td>
<td>Free time for church, reflection, reading</td>
</tr>
<tr>
<td>Day 4</td>
<td>afternoon</td>
<td>Cultural activities</td>
</tr>
<tr>
<td>Day 5</td>
<td>0800 h (8 a.m.) evening</td>
<td>Second day of farm visits, review of interview results, Student team meetings, analysis and evaluation of results</td>
</tr>
<tr>
<td>Day 6</td>
<td>0800 h (8 a.m.) evening</td>
<td>Third day of farm visits, review of results and process, Student team meetings, evaluation and summary of results</td>
</tr>
<tr>
<td>Day 7</td>
<td>0800 h (8 a.m.) afternoon</td>
<td>Fourth day of farm visits, review and synthesis of results, Student team meetings, summary of results, planning presentations</td>
</tr>
<tr>
<td>Day 8</td>
<td>0800 h (8 a.m.)</td>
<td>Final farm and experiment station visits, synthesis of results, Student presentations, planning for written report</td>
</tr>
</tbody>
</table>

Nonfarm sites and topics were included each year to build student understanding of the ecological and cultural context in which the farms operate. Native prairie remnants were toured to acquaint students with the flora and fauna of the region, plus an appreciation of structure and function of the prairie. A soils specialist familiar with geological and agricultural history used several field sites to describe and demonstrate the impacts of glaciers on soil formation. A state park with American Indian prehistoric petroglyphs provided an understanding of the original inhabitants’ perspectives on the region’s landscape. A visit to Laura Ingalls Wilder’s family homestead near Walnut Grove, MN, provided a link to early settlement, while connecting with some of the students’ childhood readings of *On the Banks of Plum Creek, Little House on the Prairie*, and other books by Wilder. Visits to these sites helped complement the historical background provided by the farmers during their interviews about their own specific farms. One of the readings considered the account of a journalist’s visit to southwestern Minnesota in the 1880s during the era of the extensive bonanza farms, which existed in the area of one of the farms visited. This helped students understand that the issue of farm size in agriculture is not a new one.

Two different travel approaches were used in the 2 yr of the course. In 1998, the group stayed at local motels in different towns each night to reduce travel time between farm sites. The final presentations were given a meeting room of a restaurant in Sioux City, IA. In 1999, students and faculty were based throughout the week at the Iowa Lakeside Laboratory (a field station owned by Iowa Board of Regents) and returned there each night after the day’s farm visits. The 1999 model proved to be a simpler, less expensive, and logistically more effective way of offering the course. Keeping the course on the move, as was done in 1998, the need to unpack and pack each day, to check into and out of motels, and to always have to seek ways to get teams together each night in a new setting was counterproductive. The facilities for the final presentations were also much better at the Lakeside Laboratory in 1999, than at the restaurant in 1998. A base camp gave students a familiar place to meet and work, consistent access to reference materials, and more free time to reflect and explore the site.

Evaluation of learning was an ongoing and integral part of the course environment. This was more informal in 1998, and more structured in 1999. An initial one-page questionnaire asked students about their backgrounds, expectations, and learning styles. Each day a one-page survey was used to assess what students had observed on the farms and their perceptions of the individual and group learning process. Results of these daily evaluations were summarized by one of the instructors for the group each day. Faculty facilitators also provided feedback to individuals and teams on a continuing basis. Faculty met with individuals/teams as requested or needed to answer questions and provide guidance. These structured methods supplemented the faculty observations of students’ engagement and behavior during farm visits and group activities. The final questionnaire was a paired interview where students asked each other questions and recorded their partner’s responses.

Faculty met each evening to share their observations and comments from students, which provided another window on learning through evaluation of the students’ and the course’s progress. This emphasis on evaluation gave faculty a good understanding of the teams’ functioning and gave them information for evaluating individual contributions to the team product. It allowed faculty a chance to intervene when needed to redirect or improve the learning environment. Knowing that students learn in different ways, this multidimensional evaluation method provided a useful opportunity to assess learning and to fine-tune the process.

**RESULTS AND DISCUSSION**

Experiential learning was assessed using the several methods described above. On the first day, students were asked about their individual learning styles. Predominant among the responses were statements about the importance of experiencing things first-hand in the context of the farm and of gaining information in a real world context directly from farmers. They appreciated seeing practical examples that illustrated farming principles, and observing the application of strategies and practices on the farms themselves. Students noted the importance of multiple types of stimuli and explanation, and the value of using all their senses—seeing, hearing, feeling, touching, and smelling. Some students mentioned the desirability of lectures; however, the majority favored experiential learning on farms and in their teams. We concluded from the final course evaluations that the course format met most of the students’ expectations, and many were surprised at the intensity of the learning process. One student wrote:

*I’ve learned more in one week visiting farms and working in small groups than I learn in a whole semester on campus.*

The principal negative comments related to the travel schedule and lack of time to reflect.

Students described the importance of standing and observing in the landscape, immersed in a farm context, for understanding how the agroecosystems worked. Sensing the challenges of farming in the field while talking with farmers expanded their worldviews. They saw a farm as a part of the watershed, the farmer as a component of their neighborhood and community, and agriculture as a feature of a landscape or agroecozone. Evaluation comments revealed that this course was different because of more discovery learning with emphasis on the experience and its interpretation, rather than on textbooks and lectures. Students found themselves engaged with complex problems and seeking alternative solutions using different criteria and types of analysis and evaluation of options. Participants viewed the course as more practical than lectures. Students described how they used observations and knowledge to describe and solve problems rather than merely memorizing facts. Overall, the evaluation of experiential learning was highly positive.

Learning in a social environment was described by Johnson et al. (1998) as distinct from the one-way deliveries in many lectures. In the conventional classroom, competition often replaces collaboration. Few meaningful relationships, if any, develop among students. In many conventional classrooms, the single instructor is seen as distant from students, conducting business but not actively learning. The format in this course resulted in more personal relationships among students and between students and faculty. One student commented:
When you live, eat, and spend all day in a van, you really get to know your classmates.

In both years, students and faculty sometimes gathered for extemporaneous folk singing sessions after the day’s business was accomplished. Such camaraderie is seldom possible within the conventional construct of campus-based courses. Because the course was offered off-campus, and 4 to 8 h from any of the collaborating universities, students could not rely on familiarity with the site nor distractions of peers. By assigning roommates and team members across universities, students were urged to develop new relationships with new classmates that they might otherwise not have known. Students also valued the opportunity to have more one-on-one time with professors, moving beyond knowing them as authorities. A student remarked:

I’ve never worked with faculty before who seriously saw themselves as co-learners with us, not experts who already knew the answers. We were searching and learning together about complexity on the farms.

Team learning was a part of the social learning environment enhanced by the group projects. One student described the differences between the conventional learning method of lecture and the group learning method:

In lecture, a student is bombarded with facts and figures and writes them down. Team learning allows us to have many conversations to discuss multiple options, share ideas, and develop new ideas together. This is one way for students to work through ideas not fully understood.

Students felt they learned better by verbalizing an idea or having to explain it to peers. Several students commented that team members were likely to contribute because in a group of peers they perceive less anxiety, less competition, and less fear of being judged by the professor. This format allowed students more freedom to learn.

Motivation for learning in students and faculty was maintained at a high level, especially during the intensive week during the course and the month-long period of final written report preparation. We observed a strong engagement with the material, healthy debate about farmer goals, and enthusiastic grappling with the complex issues surrounding decisions by farmers to pursue diverse strategies. The first-hand experience on a farm is unique and seems impossible to capture in the classroom for all students. Part of the answer may be involving multiple senses and being immersed in the context of real-world challenges. The students’ view about how and where education can occur was broadened with meeting farmers and families on their home turf, recognizing them as important resource people and validating them as co-instructors in the course. Seeing university professors in a learning mode reinforced the concept, and increased confidence for the presenter.

Faculty motivation was also high, although planning a team-taught course was both exhilarating and frustrating. Each individual took responsibility for different parts of the planning, while remaining sensitive to collaborative aspects of the process. After the long planning period and opportunity to work together under a range of circumstances, a strong level of trust emerged among the instructors and a sincere belief that everyone brought unique qualities and skills to the course. Emerging from the process was a willingness to give up time-honored teaching practices when someone on the team had a better idea to enhance learning. Each instructor was willing to volunteer to accept responsibilities in their areas of strength, and to encourage each other to expand their knowledge and capabilities from new information and new experiences.

With a sincere conviction that students are the center of creating the learning environment, as well as in changing the role of professor from the sage on the stage to a guide on the side, the entire faculty could comfortably assume this new role as facilitators, co-learners, and resource people. Both students and faculty were motivated by this approach to learning. One student commented:

It was really exciting to see the professors eager to learn, taking notes, to see them struggle with difficult issues, and to be working late at night to help make the course better.

Physical fatigue due to an overzealous schedule became an issue both years. Consequently, not everything is always positive in this kind of learning environment. The schedule was too full the first year, which was exacerbated by the daily changes in the living environment. Students and faculty stayed in six different motels over the 8-d period of the course. An overly intense schedule is particularly difficult for those students who require more time to synthesize and process new material or those students with less agricultural background. Additionally, some students needed time to learn or work individually before coming to the group. Limited time did not
allow many students to digest information or sufficiently de-
brief with faculty.

This problem was partially solved in the second year by es-
establishing the base camp approach at Lakeside Laboratory, a
facility with excellent space for meals, small group work, and
large group meetings and an on-site library. Travel time
to sites was extended somewhat each day, but students quickly
adapted to this schedule and used the travel time for synthe-
sis and group planning. A lack of enough individual time for
thought and reflection, additional reading, or keeping a jour-
nal is still a concern. Students also wanted more time for de-
briefing and reflection with the entire learning community to
help clarify what was being experienced by others during the
visits each day, to communicate suggestions for modifying the
process or schedule, and to making sure logistical details
were clear.

Dysfunctional teams were a challenge at times. Although
most students spoke highly of the experience with their team,
one team each year did not function as well as the instructors
had hoped. In one case the conflict was due to a disagreement
about the approach to use and an unwillingness to compro-
mise, while in the other team it was domination by one male
team member and his unwillingness to listen and share own-
ership with two female colleagues. We encouraged teams to
work out their problems and find solutions to these types of
challenges, as we considered this part of the learning experi-
ence. Students will likely work in teams in future job situa-
tions and conflicts will arise that they must solve. When
needed, instructors did counsel individual students, as well as
meet with the team as a whole to help provide guidance or to
facilitate solutions to organizational or communication prob-
lems.

Multiple instructors in the course had both positive and
negative aspects. Students found it rewarding to have in-
structors with different expertise and to have an instructor who
was assigned and readily available to each group. However,
leadership in such multiple instructor situations can be diffi-
cult. Miscommunication or lack of communication about
schedules and other logistical aspects of the course could lead
to frustrations among the faculty team. We were fortunate to
encounter little disagreement over the fundamental approaches
that were used in the course. If disagreement on some aspect
of instruction or administration of a course such as this one
arises, it is critical that instructors:

1. Develop their own positive group dynamics; each member
needs to feel comfortable to share ideas and to disagree, and
confident in their role in the course. Long-distance com-
munication alone may make it difficult for people who de-
sire face-to-face relational interactions, and every effort
should be made to meet in person when needed before of-
fering a course such as this one.

2. Agree on learning objectives and have a willingness to ne-
gotiate on learning methods and the roles each person will
play in facilitating learning.

3. Spend considerable time in preparation for the course and
complete agreed-upon tasks in a timely manner.

4. Review and agree on the framework of schedule and ex-
pectations at the beginning of each day.

The diversity of instructors should be recognized as a real
strength of the course and an opportunity to engage all students
in a manner that is not possible in a large lecture course. We
found this a highly valuable learning experience, both in terms
of course content and an opportunity to develop personal
friendships within the instructor team.

Costs of this course are high on a per-student credit-hour
basis. With multiple instructors (five each year) who are en-
gaged in the course for the entire week, this is a large invest-
ment for a course that includes 15 to 20 students. The stu-
dent/professor ratio is low and desirable, and comparable to
advanced seminars or tutorial situations on campus. Grant
funds allowed us to cover all transportation, housing, and
teaching materials costs, plus a few community meals. The in-
structors’ travel costs were paid, as well as honoraria to each
farmer visited. The cost of lodging and food depended on the
facilities. The facilities at Lakeside Laboratory included lodg-
ing, a large meeting room, a classroom for oral presentations,
and a kitchen, which allowed individuals to prepare many of
their own meals. Long-term sustainability of the course would
require each student to pay a laboratory fee of about $150 to
cover expenses for a course of this type, not including in-
structor time. The higher costs of this type of learning expe-
rience seem to be justified by the opportunities it creates for
truly transformational learning.

CONCLUSIONS

This intensive, experiential summer course in agroecosys-
tems analysis has proven to be a valuable learning experience
for seniors and beginning graduate students, as well as for in-
structors. After 2 yr of offering the course, we have modified
the content and schedule according to lessons learned. We con-
clude that this is a useful model for learning about agroecos-
systems that would likely work well for other subjects and
disciplines.

In course design, it is essential to start with clear course ob-
jectives and to identify the farm visits and design small group
work to meet those goals. Background readings prepare stu-
dents for the field experience, provide a foundation in practi-
cal farming systems, and broaden the knowledge of students
with less practical experience in this area, which in turn allows
them to evaluate systems more rigorously. Farms are chosen
that represent diversity in crops, farming systems, and man-
agement strategies in the region, with a bias toward smaller,
diversified family farms. The 8-d course format includes vis-
its to 10 farms that provide a range in philosophies, farm size,
enterprises, and marketing methods, as well as richness to the
activity of analyzing across farms. Teams of students evalu-
ate the farms using production, economic, environmental,
and social criteria that contribute to the farms’ long-term sus-
tainability.

We learned from the 2 yr that students appreciate the di-
rect interviews with farmers in the context of the farm, and that
engaging their multiple senses enhances the learning experi-
ence. The opportunity to design their own criteria for evalua-
tion and their analysis/evaluation across farms was a valuable
approach to developing confidence and creativity. Preparing
and presenting both oral and written team reports was an ex-
ercise in group dynamics, as well as a chance to confront a
complex task in the real world and immerse in that activity to
find solutions. We are convinced that experiential learning
greatly enhances student learning.
Use of multiple instructors adds richness to the student experience, and the format of travel, group work, and constant interaction builds camaraderie in the learning community that rarely occurs on campus. Given this intensive faculty involvement, the course is less cost effective than large lectures, but comparable to an advanced seminar course. In addition to tuition, a course fee of $150 per student would be necessary to make the course sustainable. Based on student feedback and a high level of motivation among the involved faculty, we conclude that this experiential approach to learning is a valuable model that should be integral to a number of agriculture and ecology courses in the university. The course is ongoing and dynamic with further assessments of the learning process being undertaken. Longer-term retrospective evaluations of alumni of the various classes is needed and we anticipate undertaking such assessments in future studies.

REFERENCES