Agroforestry: A Successful Model for Co-Learning[1]

Mary Lynn Roush,[2] David E. Hibbs,[2] Ray William,[3] Sheila Cordray,[4] Steven Sharrow,[5] and Stefan Seiter[3]
Oregon State University, Corvallis, OR 97331

Abstract

We built a model team and course for interdisciplinary, participatory, systems-oriented natural resource education around agroforest systems. We created a "grab bag" exercise to facilitate student efforts in synthesizing systems of increasing complexity. Four elements were critical in meeting course objectives: an early field trip that provided a concrete, common ground of reference; sequential exercises that honed students' skills with complex systems; group work that fostered integration of diverse information; and a faculty team that modeled group skills, provided key information, and facilitated student teamwork. This structured learning example provides a model for any course focused at the higher levels of learning - synthesis and evaluation - involving complex systems.

Introduction

Agroforestry is the joint production of agricultural crops, animals, or both with trees. It differs from traditional agriculture and forestry by emphasizing interactions of ecosystem components, rather than by focusing on individual components.

The challenge in agroforestry education is similar to that now facing many other natural resource educators (Caine and Caine, 1990; Bawden, 1991; Jiggins, 1994): the information is interdisciplinary, the systems are complex, and planning or problem solving is a group process. Several years ago, our team of educators created an interdisciplinary, participatory, systems-oriented course on agroforestry to meet this challenge (Seiter et al., 1995; Sharrow et al., 1995). We believe that the learning approach we developed is relevant wherever students are asked to address complex issues, and where educators want students to be actively involved in learning (Kolb, 1984). Thus, we believe that our approach and experiences will inform and inspire a wide range of educators.

A meaningful course in agroforestry must be interdisciplinary (Pearson and Ison, 1992) and systems-oriented (Senge et al., 1994). Similar to most natural resource systems, agroforest systems are complex. They include plant, animal, and social systems at many levels of organization (Kauffman, 1980). Therefore, we brought together a faculty team that represented diverse disciplines: forestry, horticulture, sociology, and rangeland resources.

Our approach involved three key ingredients: team teaching, field experience, and group projects. We developed and taught the course as a structural team, with all members present and interacting during classes. We provided early access to local agroforest sites through field trips that furnished a concrete context for students and faculty. In addition, we challenged students to build from their field experience and work in teams to design and improve agroforest systems of their own choosing. This approach allowed us to reach our objective of improving student skills in working together to synthesize interdisciplinary information in order to understand complex systems.

What We Did That Worked

We taught this course in 1994 and 1995. After the first year, we revised the course on the basis of what worked well and what needed improvement. The very successful design we used in 1995 involved three phases: a field trip, a sequence of four weekly cycles for focused group work, and an extended period for groups to design large-scale projects of their own choosing (Table 1).

Field trip

We began the course with a field trip to two local agroforest sites. As soon as we began to walk through the first site, we asked the students to observe the setting. After several minutes, they shared some of their observations: the overall lay of the landscape; transitions and "edges" between fields and trees; sounds of dogs and chain saws in the adjacent suburban neighborhood; evidence of animal and insect activity; evidence of past drought and competition in tree growth and mortality; the texture of the soil; the hiking path that was being worn into the landscape; and many other sights, sounds, and sensations from the field site. This exposure provided an example of the varied components that come into play on any landscape or site,

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[1]This is Paper 3185 of the Forest Research Laboratory, Oregon State University, Corvallis, OR 97331.
[2] Roush is Assistant Professor and Hibbs is Professor, Department of Forest Science.
[3]William is Professor and Seiter is a graduate student, Department of Horticulture.
[4]Cordray is Associate Professor, Department of Sociology.
[5]Sharrow is Professor, Department of Rangeland Resources.

Table 1. Ten-week plan for agroforestry course taught with sessions twice weekly.

Session	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Weeks 7-9	Week 10
Tuesday: discussion and student work session (1 hour each)	Introduction and Overview	Sociology I: People	Biology I: Animals and People	Biology II: Plants, Animals, and People	Sociology II: Society, Plants, Animals, and People	Self-check of progress; groups define term projects	Instructors debrief information "forays"; facilitate discussions on topics (as requested)	Groups present term projects; faculty and peer evaluations
Thursday: group work session (3 hours)	Field trip to local agroforest site; Grab Bag #1: people	Group poster showing story for Grab Bag #1; Grab Bag #2: add animals	Group poster synthesizing animals and people in Grab Bag #2; Grab Bag #3: add plants	Group poster synthesizing plants, animals, and people in Grab Bag #3; Grab Bag #4: society	Group poster synthesizing components to create an agroforest system; form new groups; choose term projects	Groups begin to plan, research, and integrate information for term projects	Groups work on term projects; faculty/coaches rotate between groups	Groups present term projects; faculty and peer evaluations
Homework (individual work)	Develop characters and story for Grab Bag #1	Research animals from Grab Bag #2	Research plants from Grab Bag #3	Research social impacts from Grab Bag #4	Progress check; mid-term evaluation of course	Informal evening evaluation of course	Individual work for group projects; reflect on progress and contributions	

some concrete experiences of the biological and social components of an agroforest site, and a context for group learning and projects. It also provided an ideal, informal setting for students and faculty to get to know one another.

Grab bags and synthesis learning

The next phase of the course was structured as four one-week cycles, which we called "grab bags" (Figure 1; Seiter et al., 1995). The objectives of these four cycles were to explore and understand (1) the plant, animal, and social systems that make up an agroforest system, and (2) the relationships among these subsystems, as they interact to form complex agroforest systems. The underlying objective was to balance structured knowledge with innovation to help students develop both their knowledge of agroforestry and their skills for analyzing systems. The grab-bag cycle approach proved to be an ideal tool for meeting all of these objectives.

The students were divided into teams. Team members were chosen by the faculty to balance and diversify their individual expertise and backgrounds. Each team was to design an increasingly complex agroforest system through the four weekly cycles.

The student teams first selected one of the sites we had visited during the field trip as the location of their agroforest. To begin the first cycle, each group selected randomly from many elements in two grab bags. The first grab bag held "identities" of fictitious agroforesters; the second held identities of fictitious neighbors. A slip of paper defined the age, sex, occupation, and other pertinent information about each person. For example, one group drew as their agroforest family a 62-year-old retired man, a 35-year-old female financial planner, a 25-year-old male logger, and a 12-year-old boy; their randomly chosen neighbors were a county commissioner and a sheep rancher. The task for the student group over the next week was to develop these characters through research and discussion and to create an agroforest family and local community, connect the varied personalities, and hypothesize about their potential interactions.

In subsequent weeks, the stories/systems became more complex as more system components (e.g., animals and plants) were added. With each addition, students were asked to critically analyze and integrate new information. For the second week, groups randomly drew a set of animals, both wild and domestic, and worked them into the existing story.

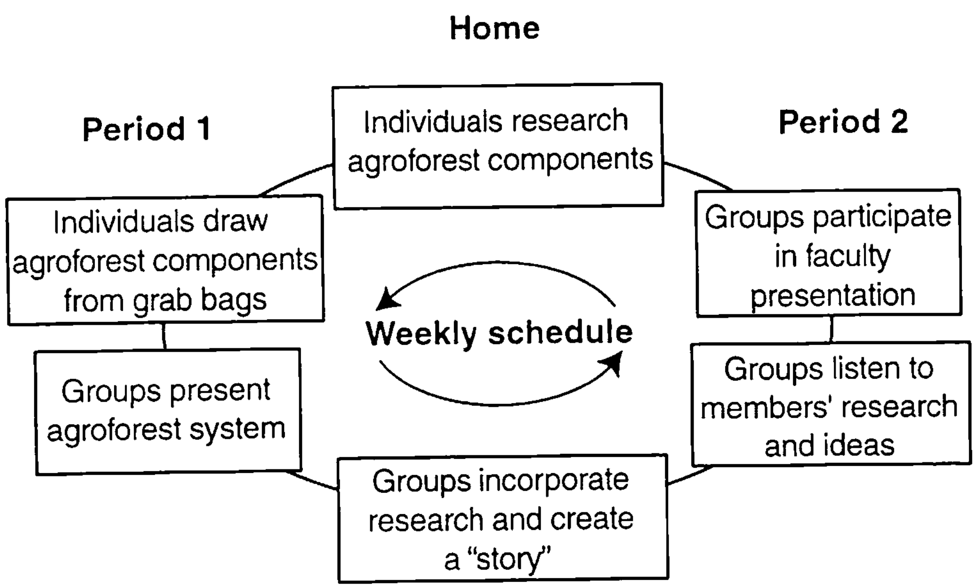

Figure 1. Weekly schedule describing agroforestry in-class and home activities.

Crop, wild, and weedy plants were added the third week. With these biological and social elements in place, students decided how to manage such technical aspects as fertilization methods, extent of interactions with the surrounding community, and protection of endangered species found on the property. By this time, the evolving agroforest systems were complex webs of biological, social, and agricultural interactions (Figure 2).

The last grab-bag component was designed to introduce awareness of real-world problems that arise in agroforest systems. Each group drew from a set of social, political, or economic problems designed specifically for their particular characters or plot. For example, one group discovered that a Native American burial ground was located on their site and that two of their high-school-aged characters had been convicted of drug possession.

To help the student groups with their task, we structured five steps for each week's iteration of the cycle. First, we provided study questions to guide them in designing a new system and to help them assess their own contributions to their group's success. Second, a member of the faculty team with appropriate expertise presented an hour-long lecture providing background information and helpful insights about each set of grab-bag elements and their possible relationships. Third, teams had time during each class session to begin integrating information they had collected individually and from the lecture into a coherent story. Fourth, group products were presented to the entire class, in forms varying from typical posters (Figure 2) to creative and interactive presentation techniques. Finally, everyone provided verbal and written feedback to the teams.

As an educational tool, the grab bag exercise more than met our objectives for the first half of the course: students successfully explored the components of agroforest systems, demonstrated an understanding of the relationships among system parts, and integrated these components into increasingly complex systems. The group discussions were always dynamic and enlightening. Students developed skills for decision-making and sharing responsibilities while they invented imaginative, creative products. Our responsibility as faculty was to coach the students. We asked relevant, sometimes leading, questions, and we circulated among groups to provide insights and expertise from our diverse disciplines.

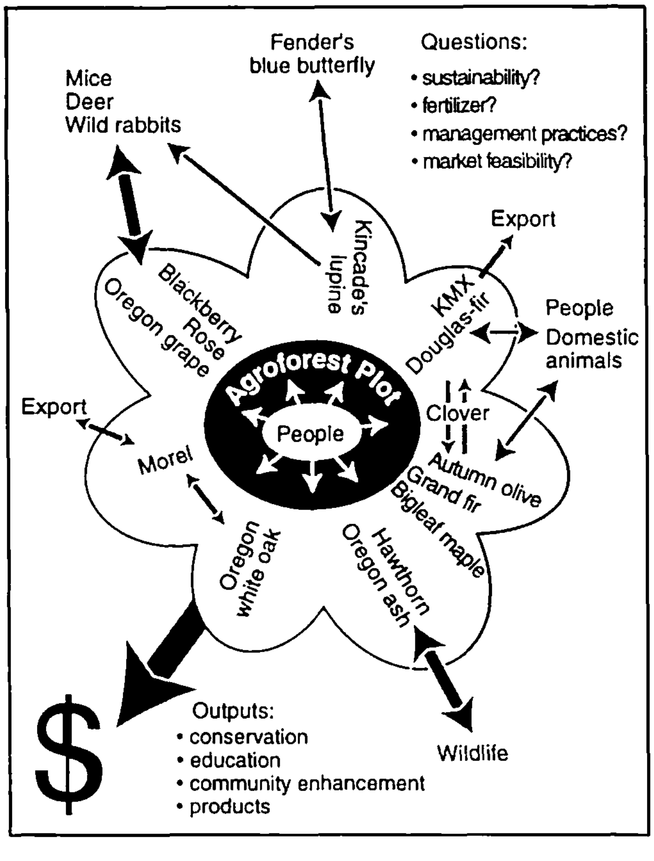

Figure 2. Student poster representing an agroforest system.

Real-world systems

During the second half of the term, students worked in new groups to apply what they had learned through the grab bag exercises to real agroforest systems of their choice. New groups were formed during a brainstorming session. After discussing the various permutations and combinations, the class settled into (1) an international group looking at two tropical agroforest systems—a tropical rain forest in the Philippines and a seasonally dry, deciduous forest on the central Pacific coast of Mexico; and (2) a local group looking at a temperate, arid to semiarid Indian reservation in eastern Oregon.

The process during the term projects was entirely student led. Faculty served as resources for specific questions that arose in the groups, as advisors for keeping the groups' progress on track, and as observers for providing feedback on their group skills and products.

Each group followed a similar pattern for developing its project. After deciding on the specific location, they began to identify the system components. Students individually searched the literature and pertinent resources and then worked as a group to share their findings and begin to integrate them into their evolving agroforest systems. More research and integrations followed. Finally, each group created a product that would communicate its agroforest system solution to the rest of the class.

Both groups chose a grant proposal as the product through which to present their system. The international group developed a proposal aimed at investigating and improving local agroforest systems, with the objectives of increasing diversity of cultivars, productivity, and community organization so as to enhance local culture in the two regions. The local group developed a proposal for a land-use partnership between the Warm Springs Indian Reservation and Oregon State University with the objective of increasing soil stability and fertility and maximizing the natural resource base for the Indian reservation. Both groups developed their proposals by identifying the specific needs of the systems involved (biological and social) and then designing an approach to meet those needs. Each group presented its proposal to the entire class at the end of the term. Students and faculty provided feedback on the products, and each group evaluated their own group and individual efforts during the course.

Outcomes

Although the term projects satisfactorily demonstrated knowledge and skills for designing complex systems, some of the most exciting learning occurred during the evolution of the proposals and was not necessarily reflected in the final products. The group focusing on a dry-temperate ecosystem in eastern Oregon, for example, began their evolution with several specific land-use opportunities. In particular, they looked at the potential for cultivating hemp as a fiber crop. The group devoted considerable research and discussion to exploring the possibilities and pitfalls of such a venture. They looked at the situation from diverse perspectives and integrated biological and social factors into a complex scenario. In the final analysis, the group determined that the cultivation of hemp was not feasible. The process by which they reached this conclusion was precisely the process that we had envisioned, and we encouraged them to present it to the entire class. Nevertheless, these students were discouraged by the seeming failure of this track, and chose to present a much more general proposal of diverse partnership scenarios between university researchers and the Tribe. Even though they failed to recognize their own success, we recognized the importance of their learning process.

Seeking input from students was important to the success of our course. Mid-term, we held a session in which students shared their views on the successes and weaknesses of the first half of the term and we discussed how to improve the remainder of the course. Discussion was both informal and candid. We learned that we were on track with the process of the course, but the students requested more specific information about agroforestry. We therefore provided weekly readings to fit the needs of the groups during the development of term projects.

Final evaluation of the course was accomplished through formal and informal comments in a traditional course-reaction survey, a post-course discussion, and written feedback from students after the class (reflection on experience: Schon 1987). Most criticisms were minor. Students were hungry for more information about the specifics of agroforestry and agroforest systems. One important criticism of the course was that we left too little time to discuss and evaluate the group projects carefully and thoroughly. We also had inadequate guidelines and criteria for evaluating and grading individual students. Thus, the challenge continues. Still, the most common and encouraging comment from students was that this course was one of the best they had taken at the university, and that "THIS is what education SHOULD be like!"

Conclusion

We see four critical elements for our success in developing an interdisciplinary, participatory, systems-oriented course in natural resources: the field trip, the grab-bag exercises, the team projects, and the faculty team. First, the early field trip provided a common, concrete ground of reference for the students. Second, the sequential series of grab-bag exercises allowed students to develop and hone their skills in analyzing and designing systems, beginning with simple systems and evolving to complex systems requiring an understanding of multiple disciplines. Third, the team projects allowed students to develop group skills while focusing on the task of integrating knowledge. Finally, our faculty team modeled group skills, presented basic information on agroforest systems, and facilitated student teamwork. Together, these critical elements helped us to achieve a model course for complex natural resource systems and issues.

Application of this model to other courses is broad and, for the most part, simple. It applies to any course where a system is the focus of study. The most difficult task is building a faculty team willing to work closely together. The team is comprised of representatives of each major discipline needed to analyze the subject system. Through the first phase of the course, analytical and group skills are built as specific disciplinary knowledge is added to an increasing complex system. During the second phase, these skills and knowledge are further developed in a focused project.

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Using Writing to Develop Critical Thinking Skills

Shelly J. Schmidt[1] Department of Food Science and Human Nutrition
University of Illinois, 905 South Goodwin Avenue, 367 Bevier Hall, Urbana, IL 61801

Abstract

Students entering today's workforce must solve complex, multidisciplinary problems, work successfully in teams, exhibit effective oral and written communication skills, and practice good interpersonal skills. In order to successfully prepare our students for the workplace, we must equip them not only with a solid foundation in subject matter knowledge, but also with critical thinking and effective communication skills. The good news is that thinking and writing are compatible, synergistic processes. As we teach our students how to write, we are teaching them how to think. This paper discusses how the principles and benefits of using writing can be integrated into both small and large college classrooms to develop students' critical thinking skills.

Introduction

Higher education is changing for the better. A paradigm shift is underway; college is no longer just an institution that exists *to provide instruction*, but one that exists *to produce learning* (Barr and Tagg, 1995; Iwaoka et al., 1996). Two powerful movements in higher education have emerged in conjunction with this paradigm shift: the writing across the curriculum (WAC) movement and the critical thinking movement. These movements can be used in tandem to transform a passive classroom of knowledge assimilation into an active classroom of exploration, discovery, invention, and learning.

One of the driving forces of the aforementioned paradigm shift is the nature of the skills needed in today's workplace. Students entering the workforce must solve complex, multidisciplinary problems, work successfully in teams, exhibit effective oral and written communication skills, and practice good interpersonal skills. The education needed by these students extends far beyond acquisition of correct information (i.e., knowledge and facts). They need to be taught how to think critically and, in turn, effectively communicate to others what they know and believe.

In order to teach students how to think critically, we need to help them better understand the true nature of the knowledge they are striving to obtain (Bean, 1996). Most students view knowledge as acquisition of correct information. Hence, they view education as the acquisition of this correct information. In this light, problems have only one right answer. We need to teach our students that knowledge is not a collection of static correct answers, but rather it is, dynamic,

[1] Professor