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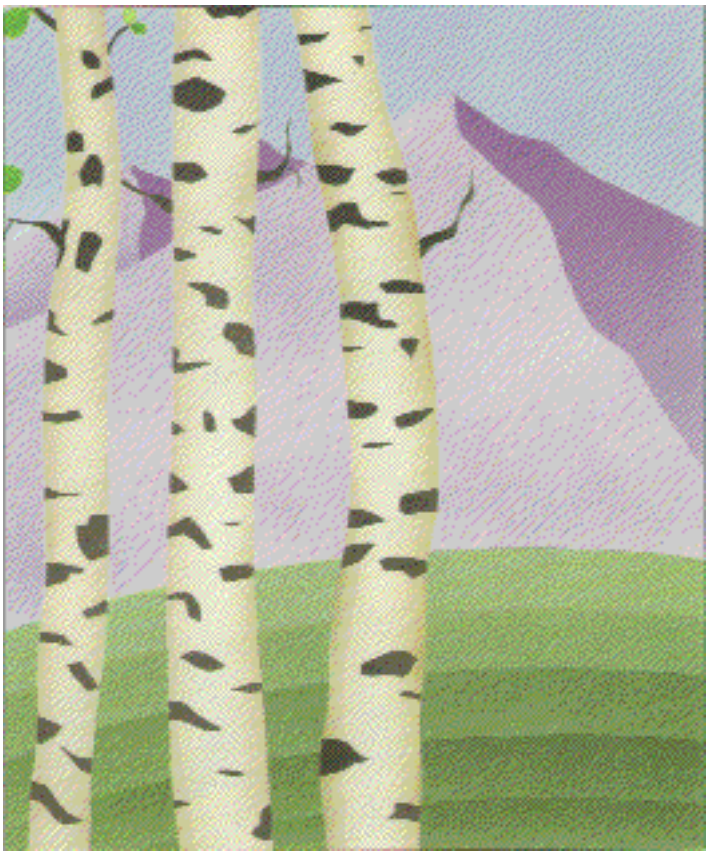
Thomas E. Kolb
School of Forestry, Northern Arizona University, Flagstaff

Proceeding of the Fifth Biennial Conference on University Education in Natural Resources



Natural Resources and Environmental Issues

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Thomas E. Kolb, compiler

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Introduction To The Proceedings Of The Fifth Biennial Conference On University Education In Natural Resources

Thomas E. Kolb[1]

The papers and abstracts that follow constitute the proceedings of the Fifth Biennial Conference on University Education in Natural Resources, held March 14-17, 2004, in Flagstaff, Arizona. The conference, hosted this year by the School of Forestry at Northern Arizona University, addressed teaching approaches, educational issues, and the scholarship of teaching and learning in natural resources sciences and management. There were 85 participants at the conference.

The conference started with two optional field trips to scenic locations in northern Arizona. Donald Arganbright led the "Cultural Tour" to the Navajo Reservation, Wupatki National Monument, and the Grand Canyon National Park. Thomas Kolb led the "Botanical Tour" to Oak Creek Canyon and the Sedona area.

The following three days of the conference included three plenary talks, four poster presentations, seven workshops, and 38 session oral presentations. Plenary talks by Mansel Nelson (Northern Arizona University), Rory Fraser (Alabama A&M University), and Ronald Tropser (Northern Arizona University) directly addressed the theme of the conference, "Natural Resource Education for a Culturally Diverse Audience." The session themes focused on introductory and service courses, culture and education, assessment and learning approaches, recruitment, learning through research, learner-centered education, teaching ethics, technology, experiential learning, communication, and graduate education.

Themes of the workshops included course assessment, problem-based learning, international forestry education, learning communities, assessment of student outcomes, and critical thinking. Terry Sharik (Utah State University) and Doug Wellman (North Carolina State University) led a special workshop titled "Administrative aspects of teaching and learning" that brought together administrators, faculty, and a few students in focused presentations and discussions on issues such as building and sustaining quality in education programs, student enrollment, accreditation, department and college structure, and partnerships.

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A dinner at the Museum of Northern Arizona was the highlight of social activities at the conference. In addition to excellent food, drink, and conversation, participants enjoyed browsing the Museum's galleries and displays.

In the final session, the future of the conference was discussed. The sixth meeting of the conference in 2006 will be hosted by Michigan State University in East Lansing, Michigan, and the seventh meeting in 2008 will be hosted by Oregon State University in Corvallis, Oregon.

I want to thank all those who helped host the conference and all those who participated.

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Fire, Myth and Mankind - An Experiment in Education

Lauren Fins[1], Michael Nitz[2], Bill Loftus[3], Rob Caisley[4] and Nancy Lee-Painter[6]

This freshman course is designed to explore our complex and intimate relationships with fire as a cultural symbol. The image of fire as both a creator and destroyer of worlds is deeply rooted in the mythos of almost every culture. It is the stuff of ancient legend and distant myth, and as modern as the yellow kevlar-cloaked heroes who march into the burning hills with Pulaskis over their shoulders. Frequent, often intense wildfires are a natural part of the American northwestern landscape and play a critical role in sustaining and rejuvenating its tall forests. Yet our traditional view of these fire events is one of devastation and destruction and our approach to management has been to eliminate or suppress forest fires no matter where they occur. Media coverage of the 1988 fires in Yellowstone National Park, while initially inflammatory, began to recognize the controversial nature of traditional fire-suppression policies and have been documenting the historical role of fire in northwestern forest ecosystems. This course provides a framework for understanding the importance of fire in forest ecosystems, and the power of journalism and theatre to use language, stories and visual images to create myth, persuade an audience and forge social change. Instructors engage students in a variety of learning experiences from the more traditional educational methods of lectures and exams to the more experiential methods used in communications and theatrical presentations. The latter include: self-discovery (students examine their own belief system and personal experience about fire), other-discovery (students interact with and interview firefighters, actors, journalists), and integration/communication (students demonstrate the power of language and storytelling through written, oral, and performance-based work). Ultimately students develop an understanding of the technical, cultural, and social complexities of our views of forests and wildfires, the importance of media in shaping public awareness and perceptions, and the possibilities of theatrical presentation to reach audiences on an emotional as well as an intellectual level. The paper will provide examples of the successes and failures of this unique class.

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Teaching about Trade-Offs: Enhancing Student Engagement in a Service Course in Agriculture and Natural Resources

Jamey L. Pavey[1] and David Ostermeier[2]

Due to urbanization and industrialization, the American public is becoming increasingly detached from the sources of its food and fiber. When asked where milk comes from, some children reply "the grocery store." Service courses in agriculture and natural resources are an opportunity for natural resource educators to help students make these connections and to inform students about the trade-offs involved in the production of the food and fiber upon which they rely. This can help to produce consumers who can make educated decisions about their consumption. We have coordinated a service course at the University of Tennessee titled "Food, Forests, and the Environment" for several years. In an effort to stimulate student engagement in the course and reflection about the topics covered, we have experimented with different course requirements, from class presentations to essay exams to journals. Utilizing course evaluations completed by the students at the end of each semester and student focus groups, we examine responses to the different course requirements and specifically evaluate the effectiveness of journaling and reflective writing assignments in increasing student engagement and reflection. Finally, we want to foster a discussion regarding how other universities are educating students regarding the trade-offs involved in the production of the food and fiber.

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How and Why to Include Sand County Almanac in Introductory Resource Conservation Courses

Dr. Susan Todd[1]

Most resource managers agree that some exposure to Aldo Leopold's writings is important in natural resource education. But there is less agreement on how to go about this. Some professors assign the book and expect students to read it on their own, but otherwise do not integrate the text into their courses. Others assign the book and discuss it in small groups. This paper describes the use of both discussion groups and writing assignments to help freshmen appreciate the depth and breadth of the book.

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Workshops

Monday – March 15

Course Assessment in Problem-Based Learning Courses using Formative, Qualitative Measures
Larkin A. Powell

Creating an International Partnership for Forestry Education (IPEE)
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Modeling Interactive Skills: Assessing Student Learning Outcomes and Pre-Professional Development in Forestry
Jan Thompson, Joe Colletti, and Steve Jungst

Course Assessment in Problem-Based Learning Courses Using Formative, Qualitative Measures

Larkin A. Powell[1]

Active learning methods such as problem-based learning provide means to focus learning experiences on course objectives. Using course assessment, instructors improve their ability to provide opportunities for students to become more effective learners. At the conclusion of a course, instructors must determine if students met the learning objectives for the course. Did students increase their knowledge base and skill level because of their learning experiences in the course? Students in a course arrive with a myriad of abilities, skills, and prior experiences, providing opportunities for student-teaching, but causing problems for course assessment. I will provide an example from my Wildlife Management Techniques course in which students participated in a pre-course/post-course writing exercise. On the first day of class, students were given 3 documents: (1) a short reading from Aldo Leopold's Sand County Almanac, (2) a photograph of very successful Nebraska waterfowl hunters from 1930, and (3) a recent wetland habitat management memo from our state wildlife agency. I asked the students to reflect on what they saw, what they thought about the document based on their previous knowledge, what kind of information they could learn from the document, what the students didn't know about the document, what the document revealed about the time in which it was written, and what knowledge and skills the students are bringing to the course that help make sense of these documents. I also asked the students to define how they would proceed with detailed research for one of the documents using the Internet. First, the students had an avenue to provide me with information about their prior experiences—some of which were extensive. I was also able to assess learning in the course, as I asked the students to complete the same exercise on the last day of class. I will provide examples from additional courses, and we will discuss ways that this method could be implemented in your course.

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Creating an International Partnership for Forestry Education (IPFE)

Rebecca L. Johnson[1] and Edward C. Jensen [2]

Representatives from four major universities (Australian National University, University of British Columbia, Oregon State University, and Yale University) and the Food and Agriculture Organization (FAO) are actively assessing the need for, and potential structure of, a new International Partnership for Forestry Education (IPFE). Recent meetings at the XII World Forestry Congress helped refine the mission and expand the partnership to include representatives of universities and other institutions with educational missions from across Europe, Africa, South America, and Southeast Asia. Start-up funds from the World Bank have been used to help develop pilot projects directed at improving forestry and natural resources education around the world.

The purpose of this presentation is to broaden the discussion to include more North American universities, to identify how other universities would like to be involved, and to generate ideas for future IPFE activities.

We will share:
History and mission of IPFE.
How it complements and expands on existing international forestry education activities.
A list of current partners (universities and international institutions whose missions include forestry education).
Pilot projects currently funded by IPFE, aimed at increasing the capacity of partner institutions to conduct broad-spectrum forestry education.
How to become a partner.

We will solicit from participants in this discussion:
Feedback on the current direction of the partnership.
Ideas on how this partnership can add value to international activities already being conducted by North American universities.
Thoughts on how this partnership can stimulate ideas, activities, and relationships not already on someone's agenda.

Ideas generated during this discussion will be shared with existing partners during our next meeting in April 2004.

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Modeling Interactive Skills: Addressing Student Learning Outcomes and Pre-Professional Development in Forestry

Jan Thompson[1], Joe Colletti[2] and Steve Jungst[3]

ABSTRACT: In response to demands from natural resource employers who desire new employees with critical thinking and problem-solving skills in addition to strong professional and interactive skills, some forestry and natural resource degree programs include such abilities as part of their student learning outcomes. Use of cooperative, collaborative, and interactive learning approaches in college classrooms often increases student competence in both critical thinking and interactive skills, and enhances students' success in the workplace after graduation. Opportunities for students to learn and practice interactive skills can be provided in a purposeful and progressive sequence embedded in both single courses and across curricula. Incorporating this approach requires effort by instructors to design activities that assist students in developing important technical skills and knowledge while practicing interactive skills with both their peers and instructors. We have used learning theory and classroom research over a six-year period to construct a novel approach to pre-professional development for students in our forestry program.

INTRODUCTION

Emerging trends in resource management problems have led to a broader range of desired competencies among new employees. In addition to technical competency (such as ecosystem assessment skills, knowledge of silvicultural systems, valuation of market and non-market outputs, use of computer technology, and analysis of inventory and remotely sensed data), employers of recent college graduates have indicated the need for interactive competency (including the ability to work in teams, to listen to and address questions and concerns, and to seek innovative and collaborative approaches to resource management). In their report on a survey conducted in 1998, Sample and others (1999) indicated that there were gaps between employers' ratings of skill importance and their ratings of the performance of recent graduates, especially in the areas of collaboration, communication skills, and managerial skills.

Educators understand that changes are also needed in higher education to provide future professionals with this new mix of needed skills. Many four-year programs have

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developed sets of desired student learning outcomes that include competencies in communication, problem-solving, and critical thinking in addition to technical skills and knowledge. However, relatively few institutions have taken a deliberate approach in assisting students to develop professional interactive skills which are explicitly tied to stated student learning outcomes. Opportunities for students to learn and practice interactive skills can be provided in a purposeful and progressive sequence embedded in single courses and across the curriculum, and in the context of assisting students in learning important technical skills.

Beginning in 1996, several forestry faculty in the Department of Natural Resource Ecology and Management at Iowa State became involved in a University-wide faculty development program (Project LEA/RN^{TM}) aimed at improving student learning (Licklider et al.,1997). Based on our participation in workshops and learning groups, we adopted the collaborative learning approach of Johnson and Johnson (1989) as a vehicle to deliver learner-centered education (Jungst et al., 2000). This approach relies heavily on student development of interactive skills to enhance learning in a cooperative context. Initially, we viewed our efforts to teach interactive skills as the means to an end, that is, productive student engagement in collaborative learning exercises. However, we now realize that enhanced interactive skills are a worthy end in and of themselves, one that addresses the needs of employers, and truly can improve many dimensions of students' lives after leaving institutions of higher education (Thompson et al., 2003b).

STUDENT LEARNING OUTCOMES

Many degree programs are in the process of identifying desired student learning outcomes, partially driven by accreditation processes and new calls on the academy to address accountability through outcomes assessment. Although this is an iterative process, subject to discussion and revision, we offer a current draft of general learning outcomes for NREM graduates of Iowa State University to frame the following discussion of interactive skills (Table 1). Some outcomes, such as "the ability to anticipate, analyze, and evaluate natural resource issues and explain the ecological, economic, and social consequences of natural resource actions at various scales and over time" are primarily aimed at student learning with respect to the technical skills of the discipline. Other outcomes, such as "the ability to communicate clearly and effectively with different types of audiences using appropriate oral, visual, electronic, and written techniques" place the primary emphasis on interactive skills. Our approach to both kinds of outcomes has been to teach them in the context of the technical content of the forestry discipline.

Table 1. Draft version of student learning outcomes for the Department of Natural Resource Ecology and Management, Iowa State University. Department faculty have identified these abilities as central to the success of students as they pursue professional careers in natural resources.

1. The ability to develop, explain and evaluate their own beliefs, values and behavior in relation to professional and societal standards of ethics.

2. The ability to anticipate, analyze and evaluate natural resource issues and explain the ecological, economic, and social consequences of natural resource actions at various scales and over time.

3. The ability to actively seek the input and perspectives of diverse stakeholders regarding natural resource problems and issues.

4. The ability to assess, analyze, synthesize, and evaluate information fairly and objectively.

5. The ability to work effectively, both individually and with others, on complex, value-laden natural resource problems that require holistic problem solving approaches.

6. The ability to formulate and evaluate alternative solutions to complex problems and recommend and defend best alternatives.

7. The ability to communicate clearly and effectively with different types of audiences using appropriate oral, visual, electronic, and written techniques.

8. The ability to recognize and interpret resource problems across spatial scales from local to global.

9. The ability to appreciate cultural diversity and understand the impact of the global distribution of people and wealth on natural resource use and valuation.

10. The ability to exercise life-long learning skills developed before graduation.

MODELING INTERACTIVE SKILLS

There are three assumptions that underlie efforts to teach interactive skills (Johnson et al., 1991). The first is that these skills are to be taught in a cooperative and safe context, where it is clearly understood that learning is a collaborative venture. The second assumption is that these skills must be directly taught. Most students do not possess the strong interactive skills necessary to enhance group work when they enter college degree programs. Although many of them have worked in groups in academic as well as extra-curricular settings, most have not received any formal training with respect to professional collaborative skills requisite for effective teamwork. Because collaborative pedagogy depends on productive teamwork to enhance student learning, it is imperative that all students in a cohort be given opportunities to learn and practice new interactive skills and engage in effective team work.

The third assumption is that after an instructor carefully structures cooperation on learning tasks and defines the skills required to be successful, it is team members who will provide important subtle feedback to each other to reinforce skill use and help all members internalize the skills. Instructor feedback is also important, but may not be as effective as peer feedback.

We have focused on a series of skills that progresses from those that help groups form and function to those that contribute to collaborative problem-solving, critical thinking, and evaluation and analysis of difficult resource management issues (Thompson et al., 2003a; see also Figure 1).

We follow the method described by Johnson et al. (1993) to engage students in learning interactive skills. This entails demonstrating the need for the skill, helping students define the skill, showing students how to use the skill, setting up situations for students to practice the skill, inviting students to reflect on the skill, building a "T-chart", and lastly, providing feedback to students as they practice to help them persevere, improve and interalize skill use. Students need to practice a number of times before they integrate specific skills in their behavioral repertoires for doing team work. These steps are described for a three specific skills in the paragraphs that follow.

LINKING INTERACTIVE SKILLS TO STUDENT LEARNING OUTCOMES

Active Listening

One basic interactive skill (a group forming skill) that is modeled very early in cooperative learning is active listening (Johnson et al., 1993; Figure 1). This links directly to a student learning outcome that we have identified, the ability to communicate clearly and effectively with different types of audiences (Table 1, item 7).

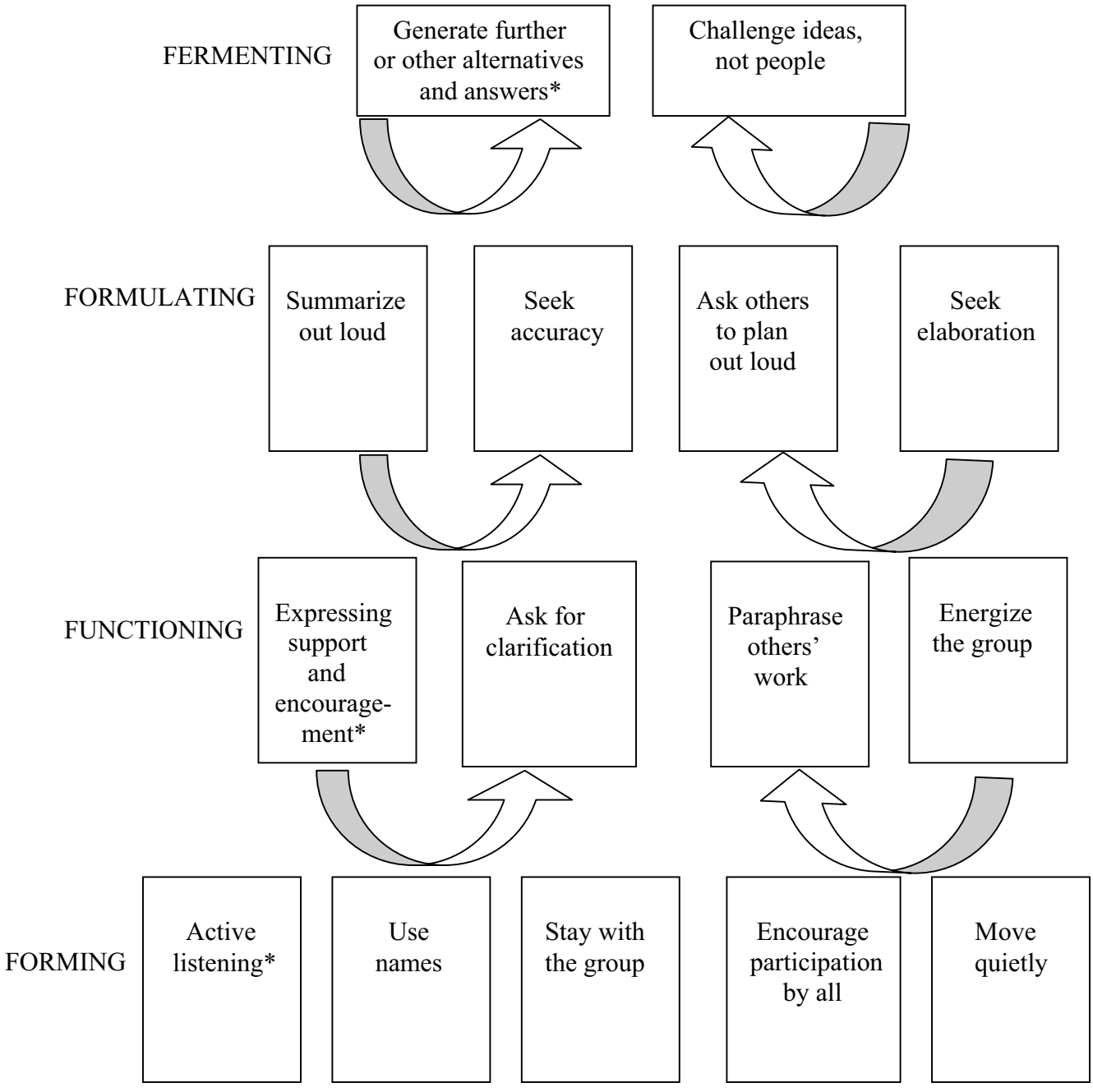

Figure 1. Interactive skills taught in the Forestry curriculum at Iowa State. Team forming skills are taught early in a sequence that progresses to rich, collaborative "fermenting" skills (modified from Thompson et al., 2003a, and adapted from Johnson and Johnson, 1989).

Active listening involves hearing what is said, thinking about what is said, and then indicating whether or not there has been understanding of what is said. Listening skills are often forgotten when helping students learn how to communicate effectively (the focus is more often placed on oral, visual, and written presentation). However, listening has been emphasized as a much-needed skill among employees, and is certainly necessary for success in contemporary participatory and collaborative resource management.

Active listening can be taught through role-playing. Students are placed in teams of two for the exercise. Each student, in turn, describes a recent important event or activity that they have undertaken to one of their peers. The other student in the pair is assigned the role of listening intently to the speaker (without the knowledge of the speaker). When the students change roles, the second listener is instructed to ignore the speaker (again, without the knowledge of the speaker). The non-listener's role becomes uncomfortable for both students before the instructor ends the activity. Immediately following the activity, students are asked to discuss their thoughts and feelings related to their assigned roles, as both speakers and listeners.

This role-playing activity is followed by defining what active listening is, and building a T-chart that describes what active listening looks like and sounds like based on students' experience (Table 2). We often post the T-chart in the classroom as a reminder of the importance of the skill, and the forms of evidence that it is being used (Thompson et al., 2003b). This is followed by additional opportunities for students to practice the skill with supervision and feedback from their instructors, until skill use becomes automatic. In the context of cooperative and collaborative learning, we have found active listening to be a profoundly important skill among instructors as well as students.

Table 2. A "T-Chart" developed by students after an activity designed to show the need for active listening. Students develop lists in columns that characterize what active listening looks like and sounds like. (There is no direct relationship between the two columns.)

Active Listening

Looks like…..	Sounds like
Nodding, shaking head	"Did you say…?"
Leaning forward	"Yes,…."
Eye contact	"Are you sure…?"
Eyebrows up	"I hear you"
Gestures (thumbs up)	"Would you repeat…?"
Smiling	"Do you think…?"

Expressing Support and Encouragement

A skill that enhances team functioning is that of expressing support (Figure 1). In our work with student teams, we introduce this skill after groups have been working together for several weeks, and after they have been invited to reflect on both effective and ineffective behaviors within their groups. At that time, most teams are ready to move to a higher level of cooperation. This skill is linked to the student learning outcome identifying the ability to work effectively, individually and with others, on specific problems (Table 1, item 5).

Expressing support and encouragement involves acknowledging and encouraging individual team members' ideas and contributions, and often serves as powerful motivation for additional idea generation and contribution to team work. Use of this skill among peers is linked to many of the positive outcomes of cooperative learning, such as greater motivation to learn, more positive relationships with others, and improved self-esteem.

Depending on classroom context, this skill may also be introduced via a role-playing exercise, where partners have a specific task to accomplish, and go through a process in which one member attempting the task is criticized, followed by the second member attempting a similar task who is given positive guidance, support and encouragement. At the end of this exercise, students define the skill, and then evaluate both their performance on the task (usually much better for those who have been encouraged) as well as their thoughts while attempting the task. Again, this activity is followed by

construction of a T-chart (which may include "looks like" items such as thumbs up, smiling, and nodding, and "sounds like" items such as "Way to go!", "I like that idea", and "keep up the good work"). As with active listening, the expressing support T-chart may be left posted in the classroom until students have begun to make routine use of the skill.

Generating Further or Other Alternatives

After students have gained mastery of group forming and functioning skills, it is possible to introduce skills that lead to rich collaborative work within their groups, such as the skill of generating further alternatives or answers to address problems or issues (Figure 1). Although the instructor may choose to impose a specific strategy for teams to accomplish this work (e.g. a process for productive brainstorming or another group protocol for promoting generation of ideas), often teams that have been working together through the forming and functioning stages will have developed their own process for performing this type of task.

Generating further alternatives enables students to see that there is more than one way to solve resource management problems and allows them to examine issues and perspectives of several stakeholder groups. This skill is particularly crucial in participatory and collaborative resource management, where compromise and identification of alternative solutions are often required to move projects and programs forward.

In our program, this skill is introduced in a set of sophomore-level courses in the forestry curriculum (Jungst et al., 2000, Thompson et al., 2003a). However, more deliberate effort to enhance this skill takes place in a senior-level capstone course in which student teams develop management plans for real-world clients. In this course, students work together to practice several problem recognition and identification strategies such as brainstorming, role-playing, "Camelot" scenarios (identifying an ideal situation and then comparing it to reality and examining the differences between the two), and why/why not diagrams (Higgins, 1994). Teams also practice collaborative problem solving by applying strategies such as "upsides and downsides", and features and benefits (Ricchiuto, 1996) to identify root causes(s)of the problem(s), generate alternative solutions, and to guide articulation and quantification of effects. Depending on the actual practice situation, student teams are provided feedback by peers, instructors, and clients.

CONCLUSION

There is a growing body of cognitive research indicating that collaborative and active learning-centered pedagogies lead to a number of desireable outcomes for students in addition to the student learning outcomes that we have identified (e.g. higher achievement and increased retention, more on-task behavior, greater motivation to learn, more positive relationships with others, and more positive self esteem; Gough, 1987,

Johnson and Johnson, 1989, Natasi and Clements, 1991, and Slavin, 1990, 1992). However, students don't always possess the skills to effectively engage with their peers in a cooperative context. Deliberately teaching these skills provides the basis for much more productive team work and lays the foundation for skills that will be important for students throughout their careers.

Although we often introduce a skill via role-playing, skill reinforcement occurs in the context of dealing with more technical forestry-related content. We have been successful in introducing a progression of interactive skills in both individual classes, and have also coordinated this approach among a group of classes (Jungst et al., 2000, Thompson et al., 2003), and have to a lesser degree coordinated this approach across our entire curriculum (e.g. from 100- to 400- level classes). We have begun the process of specifically identifying the links between interactive skills and our desired student learning outcomes. A task that remains is to design the means to uniformly assess student mastery of interactive skills as a part of ongoing outcomes assessment activities.

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Concurrent Oral Presentations
Culture and Education

Monday, March 15

Moderator: Yeon-Su Kim

Building Intercontinental Learning Bridges in Natural Resources Education for Diverse Cultures
Victor D. Phillips

Preparing the Next Generation of Public Land Managers: A Collaborative Approach to Summer Internships
Ben Baldwin, Ben Bobowski, Mark Brunson and Kathy Voth

Battle at the Bridge: Developing Ecological Problem Solvers in Communities Through Participatory Research
Jonathan W. Long, B. Delbin Endfield, Candy Lupe and Mae Burnette

Building Intercontinental Learning Bridges in Natural Resources Education for Diverse Cultures

Victor D. Phillips[1]

ABSTRACT: Natural resources education for a culturally diverse audience is central to the mission of the Global Environmental Management Education Center (GEM) in the College of Natural Resources at the University of Wisconsin-Stevens Point. GEM's purpose is to pioneer and apply practical learning methods and technology to solve natural resource problems by linking faculty, students and citizens worldwide. Building on mutual interests and joint collaboration, GEM and its international partners exchange ideas, personnel, and curricula, develop models for community involvement in sustainable development, and conduct applied research and outreach education in a variety of natural resource-based fields of endeavor.

This paper describes how GEM and its partners overseas are operationalizing United Nations Millennium Development Goals on the ground in culturally adapted and locally accepted demonstration projects. Examples of such natural resources education for diverse cultures include an international field-based seminar in Wisconsin on watershed management for watershed managers from around the world; a demonstration project of watershed catchment monitoring and water allocation in South Africa; a project on dietetics and small garden systems to support medical treatment and food security for families impacted by HIV/AIDS in Kenya; a community based ecotourism, land use planning and watershed management project in Mexico; a rural leadership and community development twinning study on water resources between Wisconsin and the Peoples Republic of China; an international student exchange and internship program between several U.S. and European universities on sustainable forestry; a conservation and environmental sciences educational curriculum project and teacher exchange between Wisconsin and Puerto Rico; and a GEM Student Ambassador Program for international learning.

INTRODUCTION

Diversity is a good thing. In nature, the myriad components, connections, and complexities of the natural resource base of the planetary life support system sustain our existence. In human society, diversity— cultural, social, political, economic, racial, gender, and other forms— enriches humanity and its various organizational structures with fresh ideas, broad perspectives, and new insights. In healthy democratic societies, diversity empowers and drives civilized society forward to improve the human condition, e.g., enhance knowledge, teach tolerance, provide access and opportunity, build peace and protect civil rights of minority opinions and groups. Because societal benefits of

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diversity are so strong, increasing democratization is sweeping the globe at many levels including governments and their agencies, universities, business and industry, and other organizations. The careful and vigilant protection of diversity is the hallmark of democratic success and freedom to live fully and to optimize human potential. Diversity provides great cause for celebration because it is the source of vitality and richness that sustains the spirit of and progress in human civilization.

This paper focuses on increasing diversity by building intercontinental learning bridges in natural resources education for diverse cultures. International programming, study abroad, student and faculty exchanges overseas, and collaborative applied research and outreach education with foreign partners in local communities offer a highly effective means for increasing diversity and helping build a sustainable future. Examples are featured from the Global Environmental Management Education Center (GEM) within the College of Natural Resources (CNR) at the University of Wisconsin-Stevens Point (UWSP) and its partners.

GEM ACTIONS ON U.N. MILLENNIUM DEVELOPMENT GOALS

The United Nations Millennium Development Goals (MDG) are an ambitious international effort for reducing poverty and improving lives, which provides a pathway to attaining sustainable development. Core human values and actions to implement sustainable development must reflect locally relevant and culturally appropriate visions for a world that "meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Sustainable Development 1987) Kofi Annan, U.N. Secretary General, has stated, "Our biggest challenge in this new century is to take an idea that sounds abstract – sustainable development – and turn it into reality for all the world's people" (United Nations 2001). Making the abstract real, and developing the capacities of individuals and societies to work together for a sustainable future is, essentially, an educational enterprise.

GEM is a highly successful educational enterprise based on strength of the UWSP College of Natural Resources, which has comprehensive offerings in environmental education, forestry, human dimensions of natural resource management, paper science, soil and waste resources, water resources and wildlife. The first conservation education major in the nation was established by Fred Schmeeckle at UWSP in 1946 during the Aldo Leopold era. The largest undergraduate institution of natural resources and environmental management (over 1300 baccalaureate and 150 graduate students) in the U.S., CNR has a virtual army of eager, well-trained students and outstanding faculty who are extending the reach of excellent CNR curriculum and outreach programming via GEM to help build capacity in the U.S. and overseas. A linkage of CNR instructional and extension approaches to providing the best possible education and services to our clients—students and stakeholders—are accomplished through Centers within the College. Examples include the Wisconsin Center for Environmental Education, the

Center for Land Use Education, the Center for Watershed Science and Education, and GEM, with others planned. CNR faculty, undergraduate and graduate students participate in GEM programs. Of note at UWSP, CNR offers Masters Degree opportunities to both outbound and returning U.S. Peace Corps volunteers.

GEM educators themselves and the learners they educate here and abroad are moving the vision of sustainable development to reality. Through education, GEM and its partners overseas foster the values, behavior and lifestyles, as well as technical and communication skills required to create a sustainable future. GEM is operationalizing MDGs by implementing practical, applied community driven development projects on the ground. GEM transforms lofty international policy guidelines into tangible, real world results catalyzed by empowering local citizens as agents of change working together.

Of the eight United Nations Millennium Development Goals listed in Table 1, GEM is contributing directly to achieving MDG #7, Ensure environmental stability, through most of its activities. Additionally, contributions by specific GEM program activities address MDG #1, Achieve universal primary education, MDG #3, Promote gender equality and empower women, and MDG #6, Combat HIV/AIDS, malaria and other diseases, as well as help indirectly via GEM international programming with positive impacts on the remaining sustainability goals.

Table 1. United Nations Millennium Development Goals.

Eradicate extreme poverty and hunger
Achieve universal primary education
Promote gender equality and empower women
Reduce child mortality
Improve maternal health
Combat HIV/AIDS, malaria and other diseases
Ensure environmental stability
Develop a global partnership for development

GEM AND U.N. DECADE OF EDUCATION FOR SUSTAINABLE DEVELOPMENT

To those of us in academia at all levels, the United Nations Decade of Education for Sustainable Development (DESD), January 2005-December 2014 is an inspired opportunity to effect change. As educators, our primary responsibility is to instill hope for the future, and to equip learners with knowledge that enables them to act as agents of change in building a better future. This is our decade to make a difference. Let's do it.

A plan for doing so is outlined in a Framework for a Draft International Implementation Scheme for the DESD developed by UNESCO (2003). It builds on the Dakar Framework for Action adopted at the World Education Forum and the UN Literacy Decade. Descriptive highlights of the framework are provided in three sections below.

Section 1

Section 1 elaborates the nature of education for sustainable development to address poverty alleviation, gender equality, health promotion, the conservation and protection of the natural resources base upon which social and economic development depends, rural transformation, human rights, peace, international understanding, cultural and linguistic diversity and the potential of information communication and technology.

The Dakar Framework for Action sees education as 'the key' to sustainable development as the basic economic and social infrastructure for sustainable development. It calls for educational strategies to build peace, hope, stability, tolerance and mutual understanding as a platform for sustainable development. Literacy for all is at the heart of ensuring sustainable development, peace and democracy. Environmental literacy is the capacity to understand the interdependence and fragility of planetary life support systems and the natural resource base upon which human well-being depends, and to identify root causes of threats to sustainable development and he values, motivations and skills to address them. Cultural diversity—our rich diversity of domestic and international human cultures—is our collective strength.

Section 2

Section 2 describes a partnership approach to the development of an international implementation scheme for the DESD at the subnational, national, regional, and international levels. Emphasis is placed upon supporting initiatives at the local level and ensuring that structures at the national, regional and international levels provide direction and guidance for local initiatives.

Ultimately the DESD aims to have education for sustainable development implemented worldwide at the local level. Because there are many diverse cultures and methods, a one-size-fits-all approach is strongly discouraged. Networking and partnerships that result in demonstration projects and activities for adaptation in locally relevant and culturally appropriate ways can catalyze participation, ownership and commitment to achieving DESD objectives successfully through a 'bottom-up' approach.

Section 3

Section 3 proposes a schedule of activities aimed at catalyzing world society for action in communication and advocacy and building momentum, partnerships and support.

GEM EFFORTS IN DECADE OF EDUCATION FOR SUSTAINABLE DEVELOPMENT

The purpose of the GEM Education Center is pioneering and applying practical learning methods and technology to solve natural resource problems by linking faculty, students and citizens worldwide. GEM utilizes 'twinning studies' of U.S.-based and foreign-based natural resources management problems that different nations and communities have in common, e.g., forest fragmentation, water quality degradation, or affordable energy. Participants from different cultures and backgrounds share and learn from each other, and adapt their new knowledge for application in culturally appropriate and acceptable ways.

Presently, there are nine (9) GEM programs based on the existing strengths and interests of CNR faculty who drive the international programming activities with partners overseas (see Table 2). Other new GEM initiatives, such as sustainable agriculture and food security associated with HIV/AIDS and other disease mitigation, are being launched.

Table 2. GEM Program Priorities

- Watershed Management
- Comprehensive Land Use Planning
- Becoming An Outdoors Woman
- Ecotourism and Nature Interpretation
- Rural Leadership and Community Development
- Sustainable Forestry
- Conservation and Environmental Education
- Sustainable Energy Systems
- Environmental Management Certification and Compliance

Within the above GEM programs, a sampling of GEM efforts underway or planned to contribute demonstrated outcomes during the DESD ahead is presented in Table 3. GEM welcomes additional partners in similar activities in these or other nations.

Table 3. Selected GEM efforts in the Decade of Education for Sustainable Development

1. US Department of Agriculture Forest Service-sponsored international seminar on watershed management.

2. US Environmental Protection Agency-sponsored watershed catchment monitoring and water allocation project in S. Africa.

3. US Agency for International Development-sponsored project on dietetics and small garden systems to support medical treatment and food security for families impacted by HIV/AIDS in Kenya.

4. US Department of Agriculture Natural Resources Conservation Service-sponsored community based ecotourism, land use planning and watershed management project in Mexico.

5. US Department of Agriculture Natural Resources Conservation Service-sponsored rural leadership and community development twinning study on water resources in Wisconsin and the Peoples Republic of China.

6. US Department of Education-sponsored international student exchange and internship program between several U.S. and European universities targeting sustainable forestry.

7. US Department of Agriculture Natural Resources Conservation Service-sponsored conservation and environmental sciences educational curriculum development project with teacher exchange between Wisconsin and Puerto Rico.

8. US Department of Agriculture Natural Resources Conservation Service-sponsored GEM Student Ambassador Program providing applied research, internships, and community outreach projects overseas for CNR students that bridge diverse cultures.

Not only is GEM proactive in natural resources and environmental management education in Wisconsin and overseas, GEM provides a strong vision and leadership in action to promote and implement campus sustainability measures at UWSP. For example, CNR students led a campus-wide student initiative that resulted in the Chancellor's signing the Talloires Declaration at Earth Day ceremonies in April 2003, which demonstrates a commitment to sustainability measures along with hundreds of other universities across the globe. CNR faculty and students are active participants on the UWSP Campus Sustainability Committee, which is working on audits and other actions to move the sustainability agenda forward.

The GEM Environmental Management Certification and Compliance Program will offer ISO 14001 training among other practical benefits to campus. GEM is hosting the 4th International Conference on Environmental Management for Sustainable Universities (EMSU 4) in Stevens Point in June 2006. In the planning stages, a new world-class GEM Building on campus will be a true showcase of sustainability. It will feature green architecture and sustainable design aimed at garnering a Leadership in Energy and Environmental Design (LEED) 'Platinum Rating' and will provide state-of-the-art telecommunications for real time access to excellent GEM and partner network programming globally.

GEM, which has at least 10 CNR online courses available currently, is exploring participation in the Global Development Learning Network, established in June 2000 by the World Bank and the World Bank Institute. This entity is a:

- growing partnership of more than 60 learning centers and public, private and non-governmental organizations;
- offering the use of interactive distance learning technologies in the context of development;
- bridging geographical distances, fast and cost-effective; for knowledge sharing, training, consultation, and dialogues on topics relevant to the developing world.

Also, GEM is interested in partnering with The Institute @..., a novel approach to implementing sustainable development policies by providing practical, expert 'how to' training to participants gathered for relevant international meetings. This entity is sponsored by the Smithsonian Institute and the UN Development Programme.

GEM PARTNERSHIPS IN BUILDING CULTURAL BRIDGES: FORMULA FOR SUCCESS

For GEM faculty and students involved in international activities, the passion and joy of working on the challenging natural resources issues stems from embracing new friends and colleagues abroad from diverse cultures who have similar passion and commitment to building a better world. Where GEM has succeeded, faculty and students have identified mutual interests with associates overseas and developed a personal rapport and friendship that foster mutual trust, respect and understanding. There is always a strong interpersonal connection that leads to a healthy sharing and exchange of ideas and subsequent joint planning of potential projects of work together. Reconnaissance trips and exchanges of personnel, curricula and other materials help strengthen institutional ties between GEM and its new partner organizations.

The inclusion of citizens in the local community is paramount to success, and this is a cornerstone of GEM activities abroad. 'Twinning studies' promote cultural awareness and appreciation of common problems and culturally appropriate solutions. Building local capacity through training modules, workshops, outreach education and demonstration projects is important to sustain continuity and progress under local control beyond the duration of the GEM collaborative sustainable development projects. Perhaps most significantly, it is important to celebrate together the successes and friendships made during the project activities.

CONCLUSION

Diversity of thinking leads to innovation and creative solutions in a democratic society with freedom of expression and protection of individual and minority rights. International education promotes exchange of new ideas and multicultural awareness that stimulate diversity of thinking. With pressing global challenges before us, building intercontinental learning bridges for diverse cultures is essential to bring people together working locally to achieve Millennium Development Goals. In the upcoming United Nations Decade of Education for Sustainable Development, educators at all levels and in all nations have opportunity to spark wonder and passion for learning that will kindle a bright flame of growing awareness, hope, and action in the hearts and minds of people to embrace sustainable development.

The Global Environmental Management Education Center is just one example of many excellent and exciting international educational enterprises acting as catalysts of change to instill and act upon hope for the future. GEM and its partners around the world are bridging cultural divides, engaging and celebrating diversity of thinking, and pioneering and applying practical learning methods and technology to solve natural resource problems by linking faculty, students, and citizens worldwide. As the ultimate investment in security in a troubled world, let this be the time for all educators to inspire and empower learners everywhere to build a sustainable future.

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Preparing the Next Generation of Public Land Managers: A Collaborative Approach to Summer Internships

Ben Baldwin[1], Ben Bobowski[2], Mark Brunson[3], and Kathy Voth[4]

In the late 1990s, the growing disconnect among agency managers, academics, and students had become apparent. Managers and educators grew concerned about the supply of experienced replacements, the lack of focused efforts to introduce new graduates into the federal workforce, and the decreased transfer of institutional knowledge within an agency and between an agency and academic institutions. Tehabi, filled this void with an internship program focusing on the technical aspects of management and the coping strategies needed to "survive" and even "thrive" in an agency culture. The program emphasizes collaboration among students, managers and educators and provides an experience with the larger organizational and environmental context of land management as well as day-to-day activities.

Now in its sixth year, Tehabi includes elements not commonly found in other academic or seasonal employment programs. Students begin with a two-week field course where they learn about organizational culture, community context, and systems theory as well as valuable field skills. Students are assigned to an agency mentor as well as a Tehabi staff "guide" with whom they will work closely all summer. In addition to performing duties ranging from resource management to interpretation, students complete weekly assignments and a final project of their own design that benefits the agency while building on aspects of their daily jobs. The results include enhanced transfer of institutional memory, completion of on-the-ground projects, and an applicant pool with the necessary skills and confidence to hit the ground running.

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Battle at the Bridge: Using Participatory Approaches to Develop Community Researchers in Ecological Management

Jonathan Long[1], Delbin Endfield[2], Candy Lupe[3] and Mae Burnette[4]

ABSTRACT: Land-based communities need problem solvers who can address ecological degradation by bridging gaps between community and outside knowledge systems. Through our experience working for the Watershed Program of the White Mountain Apache Tribe, we have wrestled with the challenge of making ecological research more useful to tribal communities, particularly those that have become highly skeptical of conventional research. Simply importing or exporting knowledge does little to solve long-term ecological problems, which instead require an active dialogue between community and outside knowledge systems to help local institutions evolve with environmental changes. To fulfill these roles, individuals need skills in listening, speaking and thinking from both community and outside worldviews. Unfortunately, university education often isolates students from their community rather than preparing them to help solve problems within the social and cultural setting of their community. Participatory research, in which members of the community help to conduct and guide a research project, provides valuable learning opportunities for individuals seeking to develop research skills. In particular, participatory research helps participants to consider the ethical implications of their work; the social setting in which decisions are made; and tactics for improving communication, managing conflict, and engaging more community members in the research process. While the roots of participatory research extend from the social and management sciences, incorporating this approach into natural science research is a sensible way of integrating ideas and resources from beyond the community with traditional ways of learning about the land.

PRELUDE

A monstrous wildfire had scorched most of the watershed above the village of Cibecue on the White Mountain Apache Reservation. Clouds were beginning to gather in the late afternoon, signaling that the summer monsoon rains would soon arrive. A Federal emergency response team was preparing for the impending floods. One of the team's first proposals was to clear debris from underneath the two bridges that connected the west half of the town to the larger world beyond. Much of the debris was composed of sediments that had washed down in the wake of a large wildfire six years earlier. After

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that earlier fire, the Tribal Watershed Program had initiated a stream restoration project in the community. As part of this project, local school children had replanted cattails and other plants at one of the bridges (Figure 1). The products of their work now lay in the path of a bulldozer. One resident of the community, whose opinion was shared by others, declared:

> *The stream is more important to us than the bridge. We do need the bridge, but if nature takes the bridge, that's O.K. We don't want you to destroy that place. Our kids worked to make it beautiful again.*

Although the members of the emergency team were experienced with working with Native American communities (most were employees of the Bureau of Indian Affairs, and a few were tribal employees), the imposition of a command-and-control system staffed by mostly unfamiliar persons did not quell the fears of the residents. Their status as technical experts in the outside world did not engender much trust among the community. Some residents even argued that they should fight the fire with the "old ways" of saws and hand tools. Many of them recalled past ecological destruction at the hands of outside researchers. In the 1960s, the Federal Government and State of Arizona had sponsored an experimental effort to increase water yield to downstream non-Indian communities by girdling and poisoning cottonwood trees along streams in the community (Long 2000). Seeing bulldozers again preparing to clear vegetation from those streams triggered the community's memory of that traumatic episode. That view of watershed management had only recently begun to be supplanted by the more participatory, community-based approach that had governed stream restoration work for the past several years.

While a crisis such as impending floods is not conducive to the informal, time-consuming, and consensus-based methods enshrined in participatory research, the confrontation at the bridge highlighted the need for the community to have more of its own problem solvers who would be aware of local concerns and trusted by the residents. The need was not to ensure that the community's voice was merely heard; rather, it was having individuals who could effectively translate knowledge between the community and outsiders to achieve a more comprehensive understanding of the problem.

Figure 1: Before the Rodeo-Chediski fire, co-author Delbin Endfield described the recovery of vegetation, including cattails planted by local students, at the bridge in Cibecue for a video on the community-based restoration work.

INTRODUCTION

During the past decade, we have been engaged in building the Tribe's Watershed Program, which today has an eight-person staff devoted to protecting and restoring the health of water resources that flow within 1.66 million acres of tribal lands. The Program grew from research to address external threats to the Tribe's sovereignty by developing local institutional capacity in natural resources management (Long 1994). The Program has moved beyond the initial objective of assuming authority over water quality protection to conserving and restoring Tribal lands and waters. Conventional ecological research has been an integral part of the Program's activities. However, participatory research methods have also played a major role in conducting work in tribal communities such as Cibecue, where residents have been skeptical of any government proposals for improving their lives (Taylor-Ide and Taylor 2002).

Participatory Research

Participatory Research (PR) and associated methodologies such as "Action Research," "Community-Based Research," and "Participatory Action Research," are rooted in the

premise that members of a community or organization can and should assume greater responsibility in researching solutions to particular problems, through which they become researchers themselves. A central theme in these approaches is to change power relationships so that historically disadvantaged parts of the community or organization have greater vision and voice in solving their problems (Levin 1999). Consequently, participatory research projects aim to make scientific research relevant to everyday people's lives rather than serving to increase the power and knowledge of elites.

The Value of Research within the Community

Conventional research efforts, on the other hand, have inspired a deep skepticism among community members and Tribal representatives, who often view scientific research as a weapon wielded by outsiders. Tribal leaders have recognized that research is needed to defend the Tribe's lifeblood, its natural resources, from being taken or degraded by outside interests. The impacts of a changing climate and growing population have created new challenges for tribal communities that must be addressed with solutions that fit the Tribe's particular ecological, social, and cultural context.

Regardless of whether natural resource problems are long-standing or new, the solutions will require working with a variety of community members who depend on the land. Particularly in rural watersheds with dispersed populations, command-and-control strategies for watershed management are much more likely to fail than systems that follow a more adaptive and participatory approach (Uphoff 1986). Land management activities, such as livestock grazing, agriculture, burning, protection of water resources, and erosion control, have long-standing precedents guided by traditional cultural practices (Long et al. 2003). Because local cultural traditions have co-evolved with local ecosystems, they may be more sustainable than management traditions imported from other ecosystems. To meet growing challenges such as environmental degradation, local institutions need time to adapt (Uphoff 1986).

Interactions between Insiders and Outside Researchers

While cultural traditions provide foundations for management, outside research can provide valuable ideas that can stimulate the evolution of those management systems. By contrasting the roles and perspectives of "insiders" and "outsiders," participatory research frameworks help to understand interactions between community members and outside researchers (Elden and Levin 1991). Insiders have direct knowledge of the organization and are primarily concerned with solving practical problems facing themselves and their organization. Outside researchers bring expertise and experience in conducting experiments, recognizing general patterns, and communicating results to others in the research community. Participatory research seeks to bridge the gap between insiders and outsiders by working together to create a "local theory" of the situation (Elden and Levin 1991).

Facilitating the exchange of ideas between insiders and outsiders is not easy, because their customs and beliefs often set in sharp contrast, as shown in Table 1. In such a climate, natural resource issues often become struggles between the "traditional ways" and "indaa bínatsíkęęs" ("white people's thinking"). Community members describe how academic or bureaucratic representatives with formal education often magnify these tensions by using big words to "show off" or "talk down to the people." Expressing similar frustrations, advocates of participatory research have criticized the notion that universities produce "expert knowers" or that a scientist's theory about one's world is more valid than one's own (Elden and Levin 1991, Stringer 1997).

Outside Society and Funding Entities	Tribal Community and Government
Institutional education	Traditional learning
Written communication in English	Oral communication in native language
Communication with outside scientific community	Communication with community members
Conceptual knowledge	Practical knowledge
Basic research into general problems	Applied research into specific problems
Conservation biology	Resource conservation
Experimental data collection and analysis	Project implementation
Formal reporting about projects	Physical upkeep of projects
Urban lifestyle including fast pace of time and individualism	Rural lifestyle such as slow pace of time and collectivism
Emphasis on objectivity through distance and open-mindedness	Emphasis on participating in the community and upholding traditional values

Table 1: Common tensions between management approaches

Being able to bridge the two worlds can help to improve ecological management, as our efforts in participatory research have demonstrated. An event in the wake of the wildfires of 2002 exemplifies the value of promoting individuals who can bridge the two worlds. Post-fire erosion threatened a culturally important wetland. A federal implementation leader suggested using metal gabion baskets to stabilize the channel at the site, but a Tribal project coordinator (one of the authors, M.B.) responded that such a treatment would not be a good solution. For one reason, metal is not appropriate for a cultural site, as many cultural ceremonies prohibit the use of metal. For another reason, she had observed many failures of gabion baskets at other locations. Fortunately, the staff of the Watershed Program had been engaged in participatory research with outside scientists to develop a riffle formation technique that uses native rock and plants materials (Long and Burnette 2000) (Figure 2). Further research had demonstrated that the technique was

remarkably similar to traditional erosion control practices (Long et al. 2003), in large part because it relied on native materials. Therefore, the Tribal project coordinator was able to recommend using the natural materials approach with support from her traditional perspective and from her experience as a collaborator in the field research.

Figure 2: Co-author Candy Lupe and an outside researcher work together to install a riffle formation at a culturally important restoration site.

While members of the community highly regard traditional knowledge, they recognize that outside education can help individuals to learn new skills and be more successful in life. For this reason, educational scholarships constitute one-fifth of the annual allocations from the Tribe's permanently endowed Land Restoration Fund. Elders have recognized that contemporary ecological research can play an important role in supplementing traditional ways of learning about the land that are in decline. For example, students who have studied plant identification are better prepared to interact with elders who are knowledgeable about traditional plants, even though there are major differences in their approach and types of knowledge. The ability to develop new knowledge while retaining the old requires considerable skill in moving between the two worlds. However, such skill can be taught and developed through practice.

Figure 3 represents different pathways through which knowledge may be transferred between the local community and the world of outside researchers. Because Apache culture compares knowledge with water, we can represent local knowledge with the traditional wicker basket, or tus, while representing non-local knowledge with a metal pail. The first path represents conventional research, in which the local knowledge has been exported from the community to outsiders. Community members have criticized this approach as, "continuous probing by outsiders who want answers and knowledge for curiosity's sake, for exploitation, or for research that does not benefit us" (Adley-SantaMaria 1997). To prevent exportation of knowledge, the Tribal community has adopted policies, including an intellectual property committee to review proposed research and publications. The second path represents the introduction of an outsider researcher into the community, where he or she is supposed to learn and support local knowledge without removing or damaging it. The third path represents efforts to bring outside knowledge to community members within the community setting. The fourth path represents conventional education, in which a community member leaves the community to learn outside knowledge.

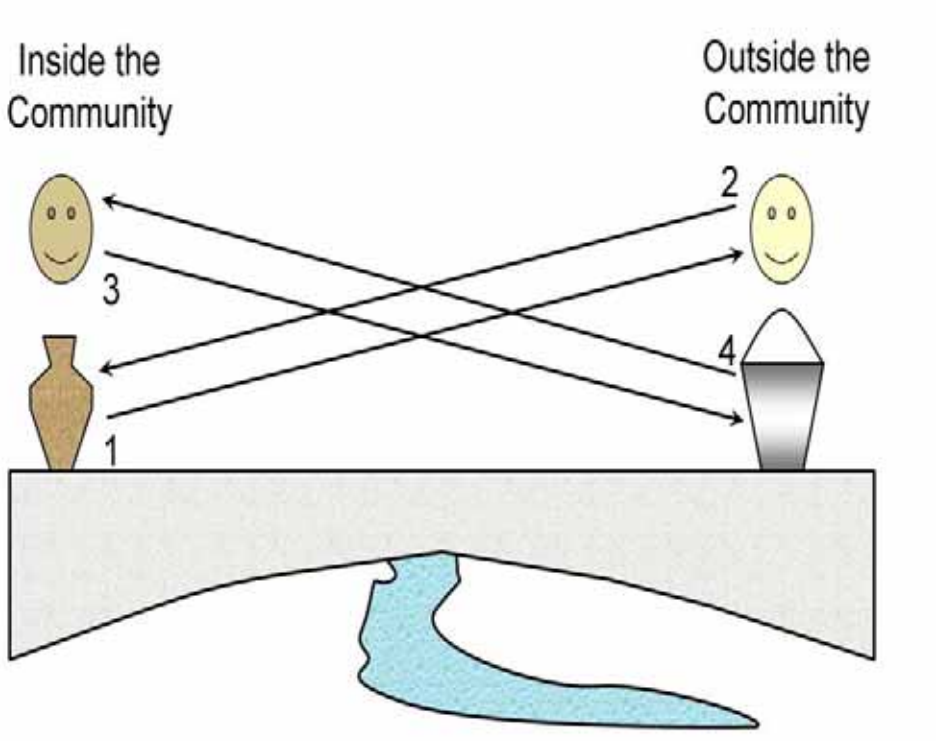

Figure 3: Four pathways through which insider and outsider knowledge can be transferred between people in the community and those outside the community.

Since the benefits of conventional research are seen as mostly accruing to outsiders, the Tribe has focused on the other paths to solve problems. Following the second path, the Tribe has recruited experienced outsiders to perform technical and managerial roles

within the government. Persons who have remained for several years have helped to lead many projects and develop local institutions. Some researchers (e.g., Cornell and Kalt 1995) have attributed part of the Tribe's economic success to its willingness to employ outsiders with specific expertise. Various strategies, such as collaborative research projects and involvement in community activities, can help outsiders to better understand the local culture (Ruano 1991). However, due to the time it takes for an outsider to understand the insider's world, this path is not particularly efficient (Elden and Levin 1991). Bringing in outsider researchers can help to address many short-term technical challenges, but this path is likely to be less effective in addressing chronic problems such as ecological degradation.

The third path brings outside education to tribal members within the Reservation setting. Opportunities such as community college and on-site training programs can help community members to develop research skills as part of their jobs on the Reservation. This approach reduces the cost of education in terms of money and time spent away from family. However, the difficulties of having young families and low incomes often make it difficult for people to commit the time and money to pursue such personal professional development. In addition, science and technical classes at the local community college emphasize individual completion of a fixed curriculum, rather than encouraging group learning through constructivist teaching methods. Many students are not well-prepared in foundational skills such as writing and mathematics. For these reasons, enrollments in college classes tend to be low, and drop-out rates are high. Attempts to make the benefits of such education more tangible (for example, by offering raises when a degree is completed) have the side-effect of seeming to devalue insider knowledge. Furthermore, tribal members who pursue degrees while remaining within the local community may not learn to see the world from such a different perspective as do those who leave the community.

Community members who follow the fourth path, by attending university often report that the experience helped them to become more open-minded and inquisitive. When they return, these individuals can stimulate institutional growth by suggesting new technologies to diagnose or address long-standing problems. Although both outsiders and tribal members who pursue higher education off-Reservation can bring in tools, community members may be better able to see the tradeoffs in adopting a new idea from the perspective of an insider and an outsider. Unfortunately, there are many obstacles facing tribal members in university. Many of the community members have not been well prepared for university-level coursework or for living outside of the structure of their home. Furthermore, removing tribal members from their home environment tends to weaken their ties to the community. Consequently, the few who commit to going off-Reservation for school may become even less likely to return.

All four paths may be appropriate for addressing particular problems, especially short-term ones. But none of these four paths is well-suited for solving long-term problems. When water sits, in either a tus or a pail, it stagnates. Consequently, the answers to long-term, dynamic problems must come from a living body of water, an evolving body of knowledge. By sharing their knowledge as they deliberate, people realize that answers

come from the stream that runs through the two worlds. The stream brings new opportunities for discovery, and washes away the ideas that no longer have value. The challenge of community-based research lies in building a bridge that promotes the exchange of ideas while not disrupting the stream below.

Tensions on the Bridge

Participatory researchers learn to highly value community knowledge, but they also believe that outside ideas can serve as a catalyst for problem-solving. Consequently, participatory research often focuses on bridging outsider and insider knowledge systems. The tensions between "old ways" and "new ways" are tangible in many communities. Efforts to build research capacity within such communities must confront these tensions to move beyond the models of either exporting or importing researchers or knowledge. Successful exchanges of knowledge occur when there is reciprocity between individuals, rather than one-way transfers. When realized to its fullest, participatory research promotes collaboration among members with diverse skills and knowledge. It is difficult to design a research effort that balances the needs of the community, the researcher in academia, and all of the local collaborators. But the result of such an effort is that answers emerge from the sharing of inside and outside knowledge.

One of the main complications of university education is that it often becomes associated with status. Rather than adding to the knowledge of the community, outside education begins to compete with it. Statements and policies that afford special status to community members with college degrees can be seen as devaluing those who do have degrees. Declarations that employees who complete degrees will be first in line for promotions and pay increases reinforce the belief that education is an undertaking for personal, not collective, advancement. An emphasis on personal achievement conflicts with an Apache norm emphasizing humility. Persons who declare that they have particular kinds of knowledge may be considered boastful and disrespectful, and therefore likely to lose that knowledge or suffer some sort of personal harm. In addition, there is a concern that knowledge that is made freely available may be misused; in extreme cases, for malevolent purposes. Consequently, traditional attitudes toward knowledge run counter to the norms and expectations of academic research, which emphasizes publicizing one's knowledge to validate it.

In many cases, individuals who have not pursued outside education are likely to have lived in Reservation communities for their whole lives, to be fluent in the Apache language, and to have a good foundation of traditional knowledge. Many are admired for being able to "speak from the heart." Many staff members emphasize the importance of humility and teamwork in completing projects, which contrasts with the individual achievement represented by a college degree. For this reason, staff members argue that new employees need to prove themselves by completing projects that involve manual labor and communicating with local land users and other community members. For issues involving land in particular, persons with college degrees may be seen as lacking authority because of their youth and inexperience. Young graduates who assume that authority comes with a particular position risk violating long-standing social norms.

There is an acknowledged double-standard regarding the expectations of tribal members and non-tribal members in management positions, because tribal members are expected to understand and adhere to cultural traditions more strongly than outsiders. If new managers propose changes in the organization, their motives are more likely to be called into question because they may be seen as having more to gain from it. Consequently, when appointed to a management position within a hierarchical system of "bosses and workers," tribal members often face greater resistance among employees than do non-members (Trosper 1988).

Freshly minted graduates must recognize that their education gives them tools for answering questions facing the community, but it does not give them the answers themselves. Incorporating participatory research methods into natural resources education for community members reinforces that research process is a dynamic learning opportunity. The process of designing and conducting participatory research helps problem solvers to learn how to communicate ideas to members of the community, to address conflicts, and to interpret how social networks and organization structures affect decision-making.

Changing Communication Methods

Since the key to solving research questions for a community lies in the interaction of knowledge systems, some of the most important skills are communication and teaching. Participatory research emphasizes that trust should be built before trying to gain information or propose solutions within the community. Customs such as introducing oneself through one's family background is an important strategy for establishing trust with community members. However, learning how to communicate effectively with outsider institutions is also important, because support for research is often leveraged from beyond the community.

Consequently, bilingual ability, in both speech and thought, is a vital ingredient of community problem solving. Many community members greatly admire skillful use of the Apache language. When a concept or project can be successfully explained using Apache words, then community members are more likely to put their faith in it. Because the Apache language has traditionally been transmitted orally, writing imposes additional barriers to shared understandings. Yet, proposals and reports written in English are the standard currency for most outside sponsors of research.

Visual techniques, such as poster displays, repeat photography, digital video, and maps, avoid the need for translation and have proven more effective for describing ecological changes. Videos (Figure 1) have allowed people to experience the vitality of the land through their eyes, their ears, and their native tongue. The warm reception by community members, especially elders, to these approaches demonstrate that new technologies can be used to stimulate, rather than replace, old ways of teaching and communicating about the land. Participatory research projects naturally gravitate towards such inclusive media to promote community participation.

Participatory research has shown that changing patterns of communication and teaching is critical for social learning and organizational growth. For example, informal and non-formal training methods, such as role-playing and group-problem solving, are often more effective than conventional lecture-based teaching (Uphoff 1986, Stringer 1997). Games, group projects, and field activities have proven far more effective than lectures in teaching watershed management concepts and skills to full-time staff members and interns. Many staff members have said that they learned more by working with an adviser than by taking classes or training courses. Such approaches are more consistent with the teacher-apprentice styles that elders have traditionally used for instruction. Participatory research often demands that participants teach each other while avoiding lecture styles that can cause friction.

Interpreting and Managing Conflict

Being able to design and coordinate participatory research requires understanding how a project can be conducted and how to manage the resources needed to get it done. For this reason, an effective community researcher must possess management skills that go beyond the technical skills that are generally the focus of classes in research methods. Interpreting the social interactions among the members of an organization is critical skill that participatory research can help develop. Persons working in science-based fields often narrowly define their work to ignore these interactions. Not uncommonly conflicts arise in which persons of different status end up blaming each other for "not doing their jobs," rather than trying to understand the social basis of their conflicts (Putnam 1996). Seeking the participation, self-evaluation, and reflection needed to understand these conflicts can become a burden on individuals who are already overworked (Santos 1991). Participatory research methods teach that leadership is less about making decisions than about improving communications (Grundy 1996). This principle helps to address potential conflicts before they grow to become too costly.

Understanding Political Dimensions of Work

In addition to considering communications and interactions, participatory research approaches also must confront how decisions are made within the community or organization. At this point, the political nature of participatory research comes more sharply into view. By encouraging community members to become agents of change, action-oriented participatory research becomes an inherently political endeavor. Because researchers with backgrounds in the natural sciences often have not been trained to understand the political dimensions of their work, they often regard decision processes as a confusing, perhaps even insidious, black box of politics. Because these issues often have long histories, researchers may not realize the ramifications of their work. For instance, issues concerning rare species have become intertwined with the complex world of water rights (Lupe 1992), so that even seemingly innocuous biological studies can become enmeshed in costly legal battles. Consequently, researchers must possess high degrees of social, political, and ethical awareness in addition to technical competence. The procedural requirements common to participatory projects, such as obtaining

permissions, arranging compensation for community members, and determining how results will be used, often help researchers to more fully consider the political and ethical ramifications of their work.

Advocates of participatory research recognize the research activities must avoid creating new elites with control over knowledge. Because an underlying goal of participatory research is to democratize decision-making, these approaches emphasize avoid concentrating authority and information within individuals by having community groups assign job responsibilities, discouraging specialization, and rotating people through positions (Uphoff 1986). Dispersing knowledge among individuals reduces the potential for any one individual to monopolize knowledge or drain it from the institutions should they leave (Elden and Levin 1991). Unfortunately, there often are not enough resources to dedicate more than one or two individuals to a research project. The need to recruit multiple persons with a wide variety of skills inevitably slows the process of developing community researchers.

Furthermore, pursuing democratic ideals may conflict with the structures and policies of the institutions that are involved in research. Community institutions that have evolved to present a unified voice to outsiders often have a strongly hierarchical structure that does not facilitate democratic decision-making. In these situations, accepting that institutions need time to evolve is important. Effective exchange of knowledge means that local institutions should evolve, rather than simply importing an idealized structure developed elsewhere. Because of institutional constraints, participatory approaches often may seem infeasible. However, striving to uphold the principles of participatory research will help to avoid many of the problems that have stymied conventional research in jaded, disenfranchised communities.

Need for Land-Focused Participatory Research

A shortcoming of participatory research as practiced in the United States is that it has been largely the domain of the social sciences rather than the natural sciences. Consequently, the focus of research has been on people's relationships to landscapes, rather than on the land itself. Staff members of the Watershed Program emphasize the need to learn directly from the land when engaged in research. For example, they assert that new project managers should be responsible for learning about and caring for a particular area. Elders describe these long-standing traditions as "drinking from places" (Basso 1996) and "having vision for the land" (Long et al. 2003). Only through such direct experience will individuals cultivate and demonstrate the proper frame of mind needed to solve ecological problems. In this way, traditional values can guide the process of conducting experiments with new technologies. Research in this manner can lead to better ways of applying old ideas. Combining the land focus of conventional ecological research with the social framework of participatory research can help build a better bridge between university and traditional knowledge systems.

CONCLUSIONS

Redressing long-term ecological problems requires changing human values, behaviors, and institutions. Communities need to cultivate ecological problem solves who possess skills in understanding and managing ecological, social, and political environments. Outsiders seeking to help solve ecological problems within a community must recognize the risks that such efforts entail. Universities in particular must acknowledge the danger of conferring special status upon community members based on their technical knowledge without teaching the responsibility to use that knowledge wisely. Neither "technology transfer" to communities nor conventional education of community members adequately cultivates shared understandings across cultures. Just as transferred technology often sits idle, college educated staff members with insufficient experience in addressing problems at the community level can become frustrated.

One of the best ways for students to learn how to bridge the worlds is to engage in participatory research, because it focuses on the critical tensions between outsider and insider knowledge systems. By being more aware of and realistic about the nature of these challenges, researchers will improve their efforts to foster the research capacity within a community. This adaptive process requires times and patience, as 'successes' collapse and 'failures' emerge as successes (Uphoff 1986). As one elder advised her grandson, a restoration project manager (and one of the authors, D.E.), "Go slowly. Listen to the land and it will tell you what to do." People dedicated to fostering community research in ecological management should heed this advice, to ensure that their efforts to build bridges do not undermine what the community has already achieved.

EPILOGUE

By proposing to clear the stream underneath the bridge in Cibecue without understanding the history of that place, the emergency rehabilitation team perpetuated the outsiders' tradition of dismissing the traditional values and knowledge of the community as outmoded. On the other hand, by contending that it would be better for the bridge to be washed out than to sacrifice the streamside habitat underneath it, some of the community members were diminishing their connection to the outside world, which includes vital services such as emergency health care. Neither side fully acknowledged the risks of different responses; consequently, each was vulnerable to making a poor decision. In the end, a compromise was reached, allowing the team to remove debris from an area extending 30 feet above and 30 feet below the bridge. Community members say that the bulldozer operator did not follow those restrictions closely enough, but they were happier about the outcome than what happened at the second bridge in town (Figure 4). At that site, more extensive dozer work was performed and significant bank erosion occurred subsequently. Since the fire, local problem-solvers have been watching the bridges to see how the stream responds, so that next time, they will find better answers.

Figure 4: Staffers from the Watershed Program examine bank erosion below the lower bridge in Cibecue.

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Workshops

Monday, March 15

Faculty Members as Course Co-Convenors with Students: Jointly Creating a Complex Ecology for Learning Communities in Natural Resources and Agriculture
Shari L. Dann, Lindsay R. Bodner and Patricia A. Harper

Trading Places: Learning From The Student Perspective
Lindsay R. Bodner , Megan E. Daniels , Kile R. Kucher , Patricia A. Harper , Shari L. Dann Deidre F. Kieren , Carole F. Robinson

Using Problem-Based Learning in Natural Resources Curriculum to Promote Critical Thinking
Mark R. Ryan and Joshua J. Millspaugh

Faculty Members as Course Co-Convenors with Students: Jointly Creating a Complex Ecology for Learning Communities in Natural Resources and Agriculture

Shari L. Dann[1], Lindsay R. Bodner[2] and Patricia A. Harper[3]

How can we, as student and faculty scholars together, delve into the complexities of issues along the natural resources/agriculture interface? How can we think deeply about such topics as urban sprawl, food production and culture, or globalization? Then, how do we take our thinking and our dialogue further, so that we make thoughtful choices about both our professional and personal lives? The Liberty Hyde Bailey Scholars Program offers one model. The declaration of this program states that we are "a community of scholars dedicated to lifelong learning." In our introductory course ANR 210, "Seminar in Connected Learning," faculty and student co-convenors and student scholars jointly identify learning interests. In this conference session, we will describe ANR 210 learning experiences that coalesced around the topics of land use and professional development. We'll engage session participants in facilitated discussion of the scholarship related to Student-Directed Learning (SDL) and Transformative Learning Theory in order to inform our work in creating learning communities that transcend the traditional boundaries between "natural resources" and "agriculture" on our campuses. We will discuss teaching and learning in terms of what Parker Palmer calls "the joint creation of an incredibly complex ecology in which each part functions on behalf of the whole and in return, is sustained by the whole." Finally, we will share dialogue about why it is important for us, as educators in natural resources, to view that "we are here not only to transform the world, but also to be transformed" (Palmer, in Let Your Life Speak).

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Trading Places: Learning From The Student Perspective

Lindsay R. Bodner[1], Megan E. Daniels[2], Kile R. Kucher[3], Patricia A. Harper[4], Shari L. Dann[5], Deidre F. Kieren[6], Carole F. Robinson[7]

ABSTRACT: A unique opportunity exists within Michigan State University for undergraduates to be valued members of a community of student and faculty scholars dedicated to lifelong learning. With the motto, "college is a journey, not a guided tour," the Bailey Scholars Program encourages students to take charge of their learning, with plenty of assistance and resources available. The program offers students a chance to tailor their education or degree toward particular interests. Bailey provides a comfortable environment to learn however is appropriate for the topic, creating a space where scholars become interdependent and gain a sense of community. Many of the core classes involve field trips, guest speakers, projects, and discussions developed by the students. Along with the actual learning experiences, the student scholars within a class determine assessment and evaluation. Classes are generally small, bringing students and conveners together at a round table. In the first of three core classes, there is a chance for student conveners to facilitate in the course. The role of a student convener is similar to that of faculty conveners. Student conveners experience the ideal practice of peer leadership; the confidence gained from being a valued member of the convener community can encourage student scholars to take the lead and initiate ideas and conversation without dominating class dynamics.

INTRODUCTION

The Bailey Scholars Program is a specialization in connected learning offered to undergraduate students in the College of Agriculture and Natural Resources at Michigan State University. The program, however, is much more than a schedule of required courses to complete for recognition on a diploma. Bailey is a community of faculty and student scholars dedicated to life-long learning. There are many opportunities for scholars

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to be engaged members of Bailey including reading circles, Wednesday lunch discussions, share nights, special events, as well as Bailey core classes. The specialization consists of three core classes, ANR 210, ANR 310, and ANR 410. These courses are taken in sequence throughout a student's learning journey. ANR 210 is an introductory course, taken upon entering the program, and ANR 410 is the capstone course, taken in the last semester before graduation. Bailey classes are unlike many traditional college courses in that students shape the entire syllabus based on group dynamics and particular interests so that every class is unique. Faculty members facilitate learning as class conveners, guiding, but not directing the course. ANR 210 includes a role for student co-conveners. For an overview of the Bailey Scholars Program, see Tagg (2003).

CREATION OF THE STUDENT CONVENER ROLE

When any first official ANR 210: Foundations in Connected Learning class meets, there is an apparent awkwardness amongst faculty and students alike. Implementing the concept of self-directed learning while throwing out traditional hierarchical roles proves to be a challenge for all co-learners. The student convener position was created as a balance between faculty and student scholars. Student conveners bring the experience of at least one core Bailey course and act as a resource to new student scholars. The availability of this resource in the classroom setting directly increases the learners' comfort level by bridging the gap between students and faculty on a daily basis. The positive effect that a student convener has on an ANR 210 class help all co-learners to participate and develop their learning together in a respectful environment.

LEARNING AS A STUDENT CONVENER

Just as every individual student's learning is never the same as another's, every student convener learns and grows in different ways with each class. Every student convener has completed at least one required Bailey course. In that course, the student was new to the program and learning how to find his or her own voice amongst a class of peers facing each other around a circle of tables. In general, the student started as a newcomer at the 'periphery' of the learning community (Lave and Wenger, 1991). In this class, the student was emerging out of the traditional learning box and into a new environment.

As a convener, a level of comfort within this setting has been developed, yet, when the student becomes a convener it is no longer his/her role to be an active voice. A convener must learn to sit back and watch the new students' transformations as they work through the challenges of being in control of their own learning. It is not the convener's role to create the process, but to guide it. As a convener, the student learns to become more sensitive and perceptive to classroom dynamics. Over a period of time, the student convener becomes more comfortable withholding comments and watching a dialogue between new scholars unfold without giving in to the burning desire to contribute comments that may influence the developing interactions. The student convener learns that the nuances of speech affect how listening ears process the speaker's message. As a

learning tool, it is the convener's job to ask questions that keep new scholars within the scope of the topic being discussed without impressing upon them personal opinion. This is an extremely difficult skill to learn when transforming from a former new scholar whose voice was always encouraged to be heard.

Student conveners experience firsthand how learning unfolds. By sitting back, observing, and absorbing all that is happening around, the convener learns how his/her own experience in self-directed learning influences and shapes his/her learning journey.

BLURRING THE BOUNDARIES

Student and faculty conveners work to smooth the transition into the Bailey style of self-directed learning. Many standard undergraduate classes consist of a professor lecturing, with notes provided on a blackboard, or with an overhead projector or PowerPoint presentation. The students sit in their desks, and take notes. There is no dialogue or discussion. The students may ask questions for clarification, but that is as far as it goes. The faculty members are "learning directors." This sets boundaries on student learning.

A more connected way to approach education is when the faculty members are "learning facilitators." This connected learning approach lacks the boundaries set in place by the "top-down" teaching methods. Lave and Wenger (2003) call this type of learning "legitimate peripheral participation." From their research, they describe learners as "apprentices" who participate within a community of practitioners, gradually moving toward more engaged, full participation in all aspects of that community. "Legitimate peripheral participation" describes the 'relations between newcomers and old-timers…It concerns the process by which newcomers become part of a community of practice" (Lave and Wenger 2003: 29).

In the Bailey Community, all members are co-learners, and boundaries between "faculty" and "student" are blurred. "We know that one of the most important things to be learned in life is the ability to work collaboratively with others in a team setting" (Fear et al. 1998). Collaborative learning is how Bailey courses are so different from other courses offered. This is when two or more persons come together as equals and partners to envision, organize, and offer active and relevant learning experiences for others. As Kris Gerulski, Bailey student, states:

As students in the program, we're placed in a position of impact and opinion as opposed to the stereotypical and limited position of observance and examination. For the first time in nearly all of our college careers, we as students of Bailey, are able to work jointly with our faculty and mentors in an atmosphere less teacher/student and more geared towards a community of learning. Being allowed to partake in curriculum planning, organizing session agendas, and initiating class discussion are just a few of the aspects that make the program so rewarding to its students. This gives you the idea behind why we call ourselves a community of learning as opposed to a simple 'classroom.'" (Fear et al. 1998).

INCORPORATING BAILEY STYLE INTO OTHER COURSES

The Bailey model for student influence in the creation of their learning journey can be applied to many other aspects of the undergraduate experience. Many degree-specific classes integrate group projects into their curriculum, emphasizing the importance of enhancing skills such as teamwork, cooperation, leadership, task handling, and professionalism. This provides students the chance to experience their influence over the material they are learning, and the mode through which they learn. Considering natural resource management, both the "art" and "science" are important dimensions of decision-making. The "science" is already a major part of a natural resource degree. However, the "art" is where students can utilize other skills and get involved in issues pertaining to their degree interests. Bailey classes encompass many different agriculture and natural resources degrees, so core course topics are initially undefined. Students are able to develop the entire class syllabus based on group dynamics and interests. However, since this is not always a viable option in single degree programs, it is critical to find alternative means for students to express themselves as learners.

Models like self-directed learning can be implemented into courses by allowing students to choose topics or projects that hold their interest yet are related, however loosely, to the main course objectives. Rather than providing all the information, conveners ask questions to get students involved in the subject, allowing them to begin inquiring on their own and pursuing issues further. In Bailey classes, students are often interested in bringing speakers into class or going on field trips to learn about an issue. Students will take responsibility for finding and contacting the people or resources from whom they want to learn. This has been very effective in directly involving students in their learning, because they determine the venue for learning.

Bailey courses, especially ANR 210, are often consumed for several class periods by the issues surrounding evaluation and assessment. In a Bailey class, students are encouraged to find a system of grading that suits their learning. Faculty have the final say in grades, however, students determine what they want to be evaluated on and how to justify their learning. When students discuss ideas on evaluation, varying issues are raised ranging from linear to lateral models of evaluation. When students have a chance to critically analyze how to justify their learning, they have evaluated what they find most important in a class. Often, issues of responsibility and reliability are addressed, as well as participation and involvement. Some classes decide on a final product such as a paper or presentation, while others choose to plan events to share their learning with the broader community. Whatever the method, having some influence in a student's evaluation is valuable to the students learning in that they are again directly involved.

CONCLUSION

Education is not something that happens to someone; it is something someone does. Education does not begin when class starts, nor does it end with a Bachelors degree or a Ph.D. One must be open and willing to learn in order to become educated. It is a decision to make and a continuing process. If someone stops learning upon receiving their degree, they have cut off many opportunities to accelerate in their field of study or line of work. However, with continual learning and evaluation, personal and professional growth is enhanced. Self-directed learning, learning in-community and many other ideas from the Bailey Scholars Program have proved to be beneficial for students and faculty alike.

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Using Problem-Based Learning in Natural Resources Curriculum to Promote Critical Thinking

Mark R. Ryan[1] and Joshua J. Millspaugh[2]

Our workshop will model the use of problem-based learning (PBL) to enhance higher-order thinking skills and promote content retention. After a brief introduction to the process and benefits of PBL, we will guide attendees through a problem case. Our Urban Deer Management case will allow participants to experience firsthand how PBL promotes critical thinking. In delivering the case we will demonstrate how a variety of active learning strategies (e.g., writing-to-learn, collaborative learning, peer-teaching, active lectures, discussion, use of internet resources) can be used within the PBL teaching format. In particular, we will showcase how we apply PBL in our classes and how we use a diversity of short and extended writing and speaking assignments intended for diverse audiences to promote critical thinking. In resolving the case, attendees will be actively engaged in problem identification, review (and peer-teaching) of learning objectives, analysis and evaluation of alternative responses, and selection and justification of a deer management plan. Throughout delivery of the case there will be ample opportunity for questions and discussion of the PBL process and associated techniques.

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Concurrent Oral Presentations/Workshop
Administrative/Leadership Aspects of Teaching and Learning

Monday – March 15

Moderator: Terry Sharik

Building and Sustaining Quality in Natural Resource Academic Departments
Terry L. Sharik and J. Douglas Wellman

Trends in Undergraduate Enrollment in Natural Resources at NAPFSC Institutions, 1980-2003
Terry L. Sharik, David B. Field, Jo Ellen Force, Dan Keathley and C. T. 'Tat' Smith

Developing a National Framework for External Review of Undergraduate Environmental Studies/Environmental Science Programs
Richard C. Smardon

Monitoring Natural Resource Education for Professional Accreditation
Pierre Zundel and Ted Needham

Building and Sustaining Quality in Natural Resource Academic Departments

Terry L. Sharik[1] and J. Douglas Wellman[2]

In his recently published book, Departments that Work: Building and Sustaining Cultures of Excellence in Academic Programs (2003. Anchor Publishing Co., Bolton, MA), Jon F. Wergin outlines characteristics of a quality academic department. These include: "(1) diverse and supportive academic community; (2) culture of collective responsibility; (3) commitment to excellence in teaching, student learning, and scholarship; (4) culture of critical reflection; (5) visionary leadership from faculty and chair; and (6) adequate resources for students and faculty." Using breakout groups, we will examine each of these characteristics, determine their applicability to natural resource programs, and brainstorm over strategies for attaining and sustaining these attributes.

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Trends in Undergraduate Enrollment in Natural Resources at NAPFSC Institutions, 1980-2003

Terry L. Sharik[1], David B. Field[2], Jo Ellen Force[3], Dan Keathley[4] and C. T. 'Tat' Smith[5]

Undergraduate enrollments were obtained by degree programs in natural resources for a representative sample (n=30) of universities having membership in the National Association of Professional Forestry Schools and Colleges (NAPFSC). Nationally, enrollments dropped to a low point in 1987, increased sharply to a maximum in 1995, and then decreased steadily through the present (2003). This trend differed little among geographic regions. Reasons for this seemingly cyclic behavior in enrollment trends are not known, but may be related to basic aspects of the economy and their influence on career choices made by prospective undergraduates. Interestingly, the most recent downturn in enrollments occurred while many natural resource programs were diversifying their degree offerings to include non-traditional subjects such as environmental studies and science, applied ecology, conservation and ecosystem science, and urban forestry. This downturn does not bode well for agencies and organizations who, with sharp increases in retirements, are projecting a strong demand for natural resource graduates over the next five years.

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Developing a National Framework for External Review of Undergraduate Environmental Studies/Environmental Science Programs

Richard C. Smardon[1]

Since National Association of Environmental Profession's (NAEP) struggles with academic certification - and academic programs of excellence in the 1980's – there has been little recent activity. It is the author's position that we need a model process for self-study and external review that can be utilized by environmental studies programs across the country. This same process could be "blessed" by NAEP – specifically in terms of outcomes and professional skill development objectives. Thus instead of a rigid certification process – we could have a framework which meets that meets NAEP needs as well as academic program external review needs. Recent experiences with a review of a Texas Environmental Studies/Environmental Science Program and a proposed review of a New York State ES program will be discussed as examples for this process.

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Monitoring Natural Resource Education for Professional Accreditation

Pierre Zundel[1] and Ted Needham[2]

University accreditation is fundamentally an educational program quality monitoring and assurance process. The purpose of this paper is to examine forestry university accreditation as a means of monitoring quality. Accrediting natural resource educational programs is in a state of transition in North America and hence confusion and uncertainty. This analysis will enhance our understanding of accreditation so workable approaches can be developed that lead to continual improvement in the quality of natural resource education. We will analyse accreditation from four perspectives: 1) different theoretical approaches to system monitoring - i.e., Inputs vs Outputs vs Process monitoring; 2) accreditation within the context of an education design system, looking at: Student > Program > Outcomes; 3) reviewing the historical development of accreditation in the US and Canada, and; 4) comparing educational accreditation with forest certification approaches.

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Concurrent Oral Presentations
Assessment/Learning Approaches

Tuesday – March 16

Moderator: Gary Blank

Academic Performance in Writing Intensive Courses: Can We Better Prepare Transfer Students?
Janice E. Faaborg, Mark R. Ryan and Joshua J. Millspaugh

Assessing Programmatic and Course Effectiveness in Teaching Using a Community Approach
Michael R. Bridgen, James Savage and Wayne Allen

Teaching Leadership and Public Speaking Through Service Learning and Independent Study
John R. Seiler and Jeffrey L. Kirwan

Practicing Sustainability: Evaluation and Redesign of a Capstone Course Entitled "Integrated Natural Resources Planning"
Dr. Chuck Harris, Erin Seekamp and Lauren Fins

Academic Performance in Writing Intensive Courses: Can We Better Prepare Transfer Students?

Janice E. Faaborg[1], Mark R. Ryan[2] and Joshua J. Millspaugh[3]

The Department of Fisheries and Wildlife Sciences (FWS) at the University of Missouri is experiencing an increase in the number community college transfer students. Previously we reported data indicating these students, on average, do not succeed academically as well students who begin their college experience at MU. We are strongly committed to understanding why these students may encounter academic difficulty and designing academic programs to help them succeed. The Columbia campus of the University of Missouri requires all students to take 2 "writing intensive" (or "writing-across-the-curriculum") courses, one of which must be in the student's chosen academic major. FWS requires a third writing intensive course, which usually results in an additional WI course in the student's professional curriculum, by definition an upper level course. Students transferring to MU typically miss out on introductory courses that are taught WI. Therefore, their first WI experience usually comes in an advanced course in their major field. Based on our observations while teaching some of these WI courses, we hypothesized that transfer students had greater difficulty with writing than non-transfer students. We present data comparing transfer and non-transfer student performance in WI courses taught within in our department. We also compared transfer and non-transfer student performance in non-WI, advanced courses for our majors. We conclude by offering suggestions for helping transfer students succeed academically.

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Assessing Programmatic and Course Effectiveness in Teaching Using a Community Approach

Michael R. Bridgen[1], James Savage[2] and Wayne Allen[3]

Individual learning is affected by the total learning environment to which students are exposed. Within a small community, such as the Ranger School, students frequently interact with faculty, their families, other college staff members, food service personnel, physical plant personnel, alumni, and even individuals from the local community. As these groups recognize their impact on students' learning, they take a greater interest in helping to make the learning experience more effective. Our faculty has implemented a process by which each of these groups may contribute ideas and make changes to the non-academic learning experiences of our students. Specific changes to individual academic courses may similarly be improved using a non-threatening assessment process among the faculty members. An example of a community-wide assessment of a dendrology teaching method will be demonstrated.

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Teaching Leadership and Public Speaking Through Service–Learning and Independent Study

John R. Seiler[1] and Jeffrey L. Kirwan[2]

In 1998, we began offering an independent study to primarily juniors and seniors that has served as a substitute for public speaking in most of our majors in the College of Natural Resources. Selected, outstanding students in our college develop a natural resources based presentation that they then deliver to between 15 and 20 middle school biology classes. An interactive on-line outline of each presentation allows the public school teachers to review and schedule presentations to meet their curricular needs and situation. The students keep track of all their scheduling on-line and through e-mail. Students are also required to develop web pages that contribute to our FORSite web page (http://www.fw.vt.edu/dendro/forsite/welcome.htm). Some of the presentations and web sites developed involve scientific investigations performed by middle-school students who then report their results and conclusions over the web. The Virginia Tech Service-learning Center supplies financial support and assistance in syllabus development and evaluation and reflection procedures. Undergraduate student performance is based on teacher evaluations of their presentations, success in communicating and scheduling with teachers, and their web site contribution. Insights and observations gathered over the five years we have offered this course will be presented.

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Practicing Sustainability: Evaluation and Redesign of a Capstone Course Entitled "Integrated Natural Resources Planning"

Dr. Chuck Harris[1], Erin Seekamp[2] and Lauren Fins[3]

This paper presents our progress to-date in evaluating and redesigning a senior-level capstone course for the integrated core curriculum in the College of Natural Resources (CNR) at the University of Idaho. This course, entitled "Integrated Natural Resources Planning," is now being taught for the 9th semester to all College seniors. The course focuses on: understanding complex issues such as sustainability and ecological integrity; assessing alternatives for management where issues are currently contentious; planning for programmatic implementation; and refining students' skills in working in teams, critical thinking, writing, and speaking. We first describe the history of the course, and then report some key results of evaluation research to assess its past effectiveness. The purpose of this research has been to further develop and improve upon the course over the last semester. The paper also describes changes currently being made in the course and their perceived effectiveness to-date, which are founded on a teaching approach of a sequential, building process of reviewing and applying resource management topics, skills, and planning exercises. Specifically, course modules consist of (1) a review of planning concepts, socio-economic and biophysical assessment processes, GIS applications, and disciplinary management principles and tools, (2) practice in applying these concepts and tools to real-world case studies, based on in-depth and comprehensive data-bases and management models; and (3) honing students' presentation skills in reporting the results of these applications. One significant change in the course was that it adopted a service-learning model for its final, capstone project. That project focused on the local landscape in which the UI is located, and it applies planning and assessment processes to provide the local county planning department with maps, data, and recommendations it will use as it begins revising its comprehensive land-use plan. Initial results of evaluation of this course redesign were mixed, but in general a large majority of the students reported that the class was somewhat or very effective in meeting its learning performance objectives. Issues raised by the evaluation results for interdisciplinary, capstone courses in natural resources are discussed.

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Concurrent Oral Presentations
Recruitment

Tuesday – March 16

Moderator: Marty Lee

The Role of Student Services in Recruitment and Retention in the NAU School of Forestry
Katherine Leao and Laura E. DeWald

Undergraduate Recruitment Strategies at Penn State's School of Forest Resources
Betty Harper

The Role of Student Services in the Recruitment and Retention of Undergraduate Students at Northern Arizona University's School of Forestry

Katherine Leao[1] and Laura E. DeWald[2]

In times of declining enrollment, increasing budget constraints, increased FTE scrutiny, and the need for departments to justify their personnel, having a student services coordinator (SSC) might seem like a luxury position that is subject to elimination. Yet, we suggest that a SSC is crucial to forestry programs, and that the benefits far outweigh the costs. An effective SSC can provide personal attention and mentoring which are keys for successful recruitment and retention, therefore, increasing FTEs. These key activities are often neglected without a SSC, because everyone's time is already overcommitted. Our presentation describes the crucial role our SSC plays in the School of Forestry at NAU. We will discuss the benefits of having a SSC to provide individualized attention to prospective students (especially merit scholars), to develop marketing strategies specific for forestry programs, to provide individualized advising, to coordinate summer and permanent job opportunities, and to help students with their resumes and job applications. We will present data to illustrate the benefits of our SSC position that outweigh the FTE cost, and will discuss desired characteristics and qualifications that we think make a SSC effective.

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Undergraduate Recruitment Strategies at Penn State's School of Forest Resources

Betty Harper[1]

ABSTRACT : Enrollment declines in natural resources programs across the nation since the mid-nineties have raised concerns about the future of natural resources education. Since its peak in 1998, enrollment in Penn State's School of Forest Resources has dropped from a record high of 535 to 315 in fall 2003. At the same time state and federal agencies seeking to maintain and diversify their workforce are facing unprecedented rates of retirement. To address this issue, the School of Forest Resources is continually evaluating its recruitment and retention efforts. Gone are the days of waiting for students to come to us. Current recruitment and retention strategies include: 1) marketing to the large pool of existing undecided Penn State students, 2) marketing to Penn State advisors in other programs and at other Penn State locations, 3) recruiting at other "feeder" institutions, 4) summer natural resources experience programs, 5) increased personal contact with potential students, 6) peer-to-peer recruiting, 7) increased scholarship funds, and 8) retooled marketing materials and web presence. These strategies are under constant evaluation and unsuccessful efforts discarded so that new tactics may be tested. While we wait to discover the ultimate effectiveness of these new strategies, their very nature reflects an important and fundamental change in attitude toward student recruitment and retention at Penn State's School of Forest Resources.

INTRODUCTION

In 1999, undergraduate enrollment in Penn State's School of Forest Resources (SFR) was at an all-time high. With a total of 560 students across the Forest Science, Wildlife and Fisheries Science, and Wood Products majors the only enrollment concern was being able to offer enough lab sections to keep all of our students on track for graduation. In the five years since, enrollment in the SFR has suffered an alarming and sudden downward trend. In fall 2003, only 315 students appeared on our rosters. At the same time the SFR began to examine its recruitment strategies, information began to come in from other universities facing similar declines. Data collected by Terry Sharik and Kathy Earley in 2003 indicated that total enrollment in forestry and natural resources related programs at universities nationwide has declined by approximately 33% since 1995.

While student interest in natural resources professions appears to be decreasing, the demand for professionals is on the rise. In 2000, the U.S. Forest Service released its 2001-2005 Workforce Plan. The plan outlined an anticipated loss of 30% of the Forest

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Service workforce by 2005. The greatest numbers of external hires are projected to be Forestry Technicians, Foresters, and Wildlife Biologists. The fastest growing positions are Botany, Fisheries Biologist, and Soils Scientist. Underlying the Forest Service's needs for new hires is a strategic emphasis on increasing the diversity of their workforce. In 2002, the Forest Service increasing its permanent workforce hiring by 8.6% (U.S. Forest Service, 2002) and almost half of these hires were in entry-level positions. Most recent estimates indicate that they will be hiring 7000 more people over the next five years. The Forest Service is not alone in this predicament, other federal natural resource agencies like the U.S. Fish and Wildlife Service and the U.S. Park Service face a similar hiring situation. Where will these new employees come from, if not from natural resource programs?

RECRUITMENT STRATEGIES

Five years ago the SFR and many university natural resource programs had the luxury of waiting for good students to come to us. Today we must actively seek to recruit a diverse student body from a pool of candidates increasingly drawn to careers in business, healthcare, and law enforcement. The SFR has developed a seven-tiered recruitment strategy aimed at not only increasing the number of students in its classrooms, but also quality and diversity. This strategy includes: 1) attracting undecided students, 2) recruiting from two-year programs, 3) offering summer programs for high school students and teachers, 4) increased personal contact between SFR faculty/staff and potential students, 5) peer-to-peer recruiting, 6) increased freshmen scholarships, and 7) marketing.

Strategy I - Undecided Students

In spring 2004, Penn State University had 6000 students officially listed in the Division of Undergraduate Studies (DUS), the enrollment program for students exploring major options. In addition there were 2500 students in the College of Business and 3600 students in the College of Engineering who were not yet formally accepted to a major. Many of those potential Business and Engineering students will not be accepted into those high demand colleges due to strict enrollment controls. In addition to the 35,000 undergraduate students enrolled at Penn State University Park, an additional 30,000 are enrolled at 23 other Penn State locations that do not have advisors or programs in forestry, wildlife, fisheries, or wood products. The most efficient use of resources dictates that the SFR target these students who are already at Penn State. To do this, the SFR maintains contacts with advisors in DUS, Business, and Engineering and provides them with specialized program materials to share with students. For example, the SFR has developed Wood Products major fact sheets that show a first or second-year Business or Engineering student how their existing courses can be used in the Wood Products program and how this major addresses their interests and career goals. In addition, the SFR is developing a direct mail strategy targeting students that have recently learned they were not accepted to their first-choice major.

Strategy II – Technical Programs

In the Commonwealth of Pennsylvania there are three two-year technology programs that have historically sent small numbers of students to Penn State University Park to complete their baccalaureate degrees. Two of these are Penn State programs: the Wildlife Technology program at Penn State DuBois and the Forest Technology program at Penn State Mont Alto. The third is the Forest Technology program at the Pennsylvania College of Technology. Over the past four years the SFR has cultivated its ties with these programs. The SFR undergraduate program coordinator makes frequent visits to these campuses and works closely with students considering the transition. Curriculum coordination has increased to facilitate the acceptance of credits from the two-year programs into the SFR. The results of this effort have been impressive. In the first half of the 1990's only a very small number of students from these technician programs were matriculating into the SFR, but over the last few years almost 50% have made the transition.

Strategy III – Summer Programs

Faculty and staff in the SFR have developed or participate in a number of summer programs aimed at bringing high school students and their teachers to campus and introducing them to the SFR. These programs include the Conservation Leadership School (CLS), Food and Agricultural Sciences Institute for Academically Talented High School Minority Students (FASI), the Pennsylvania Governor's School for Agricultural Sciences (PGSAS), and the Forest Resources and the Aquatic and Fisheries Science Institutes for Teachers (FRIT and AFSIT). CLS gives high school students the opportunity to spend two weeks living and learning in Penn State's Stone Valley Experimental Forest. A number of our faculty and staff work with students during this program to cultivate their interests in the environment. The FASI program is a one-week living-learning program that introduces minority students to programs and careers in natural resources and agriculture. The PGSAS brings some of the best students in the state to spend five weeks on campus in an intensive agricultural and natural resources educational program. In addition to these student oriented programs, the FRIT and AFSIT programs are organized by SFR faculty to provide teachers with the tools to develop hands-on environmental curricula for their classrooms.

Strategy IV – Personal Contact

Prior to 1999 SFR material was distributed on request but no additional contact was made with potential students. In 1999 the SFR developed a database to track all such contacts and ensure that a organized series of follow-up contacts was made. Two weeks after receiving an information packet, potential students receive a second letter inviting them to visit campus and providing instructions for organizing such a visit. Visits are organized to include meetings with representatives of multiple majors if necessary, as well as the traditional campus tours, admissions and student aid counseling. Whenever possible, potential students and their families meet with the undergraduate program coordinator, the undergraduate programs staff assistant, and at least one additional faculty member in

their major of interest. When students do matriculate into SFR programs it is possible to trace back to our initial point of contact with them and determine our most effective strategies. Likewise when students do not matriculate it is possible to query the database to discover any common points at which we are losing students.

Strategy V – Peer-to-Peer Recruiting

The voices of peers can be some of the most influential in the college and major choice process. Recognizing this, the SFR attempts to connect current and potential students. Potential students visiting campus are escorted by Penn State students. Likewise, those students that have been offered admission to the SFR are telephoned by current Penn State students. Whenever possible the current student is an SFR student. If that is not possible, the student is a member of the College of Agricultural Sciences, of which the SFR is one unit. In addition to these personal contacts, the SFR-affiliated student societies, including student chapters of the Society of American Foresters, The Wildlife Society, and the Forest Products Society, send congratulatory letters to students who have been offered admission.

Strategy VI – Scholarships

Traditionally the SFR has been conservative in its scholarship offers to first-years students because of the risk that students will change major. However, recently the Scholarship Committee has begun to take a more proactive approach to recruitment. In 2003-04, the SFR offered four new scholarships to outstanding incoming first-year students. These scholarships were for $5000/year for up to four years. Every student being considered for this scholarship had a phone interview with the SFR undergraduate program coordinator to determine their level of interest and commitment to the program. To help ensure retention of these students, the requirements to maintain this scholarship from year to year include regular meetings with an academic advisor and active participation in at least one SFR student organization.

Strategy VII – Marketing

As a final but critical tool in the SFR recruitment strategy, all marketing materials have been, or are in the process of being revised. In 2003 the SFR web page was completely redesigned to be more user-friendly and provide information to potential students and their families. In addition, one page fact sheets were developed to illustrate post-college career options for each SFR major. Currently, new brochures featuring dynamic photography and bulleted highlights rather than extensive text are in development. These focus on our field and hands-on educational experiences and the use of advanced technology and will feature a diverse and representative group of students.

RESULTS AND DISCUSSION

By and large the recruitment efforts instigated by the SFR are in their early stages and the results are not yet clear. However, there are some positive signs. In 2003-04 offers of admission to students indicating a major in the SFR were up 47%. As previously indicated, the number of students moving from Penn State's two natural resources technical programs into the SFR has grown from an insignificant number to almost 50% of their graduates, or approximately 20 students a year. As many as 20 additional students per year may be coming from the Pennsylvania College of Technology's Forest Technology program. The SFR recruitment database has also given us new information to help direct our efforts. The vast majority of potential students continue to be referred to the SFR through our College recruitment effort; however a growing number are discovering us through our web presence.

Recruitment strategies in the SFR are an ongoing and constantly evolving process. When recruitment first began to receive priority our efforts were widespread and unfocused. Many strategies and efforts were attempted and rejected, and new approaches are continually being tested. Although it is too soon to say if this added effort will result in increased enrollment, we feel confident in saying that without these active recruitment efforts, the situation would be far worse.

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Concurrent Oral Presentations
Learning Through Research

Tuesday – March 16

Moderator: Marty Lee

An Uncommon Undergraduate Experience: Conducting Research and Fieldwork in Ecological Restoration
Robin Long and Pete Fulé

Inquiry-Guided Learning Through Collaborative Research
George R. Hess and C. Ashton Drew

An Uncommon Undergraduate Experience: Conducting Research and Fieldwork in Ecological Restoration

Robin Long[1] and Pete Fulé[2]

The Ecological Restoration Institute (ERI) at Northern Arizona University offers a formal program to encourage undergraduate students to integrate research and educational activities. In the past three years, 55 undergraduates representing 18 majors have been financially supported to participate in ecological research and practical work experience. Students selected and awarded assistantships work as year-round researchers in campus laboratories and as summer field crew assistants at research sites across the Colorado Plateau. In addition to their employment, students are required to take FOR 380 Ecological Restoration Principles and FOR 382 Ecological Restoration Applications to better understand the context of their work. Before graduating, students complete a senior project that consists of either an independent research project or an internship with an agency committed to forest restoration. Every year the Institute has proudly sponsored seniors to present their research at professional conferences and symposiums. ERI alumni have been well prepared for entry level careers in ecology or graduate studies. A strong interdisciplinary approach invites freshmen and sophomores from all majors to apply, thus contributing to the university's recruitment and retention efforts. This unique campus program targets underclassmen and minorities and provides specialized mentoring thanks to a diverse team of faculty, staff, and graduate students.

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Inquiry-Guided Learning Through Collaborative Research

George R. Hess[1] and C. Ashton Drew[2]

ABSTRACT: In the natural resources, graduate work tends to be undertaken by individuals. Graduate students need more experience working collaboratively, which is how complex natural resources issues are approached in a professional environment. A collaborative research course is designed to provide that experience. The essence of the approach is to build a small team of advanced graduate students and lead them as peers in a collaborative research project addressing a complex and unsolved problem. A successful course combines six key ingredients: (1) technical and professional development objectives; (2) a real-world, controversial topic; (3) real-world products; (4) strong collaborators; (5) a common foundation; and (6) open channels of communication. The technical and professional development objectives are inextricably linked with the product of the course. Collaborative research is about organizing the efforts of people with diverse skills to produce results. Technical objectives define the subject and nature of the product, while the process of creating the product determines professional development objectives. A controversial topic attracts student interest and ensures a diversity of perspectives. The instructor serves as team leader and is responsible for quickly providing a common foundation to prompt further inquiry, guiding team members through decisions, removing obstacles, and facilitating connections with other experts. Students have responded positively to this approach. When asked "What was the most important thing you learned in this course?" students focused on professional development. They highlighted the value of working on a real problem, learning how to collaborate with peers, creating a tangible product, and beginning to network with other professionals. A complete description of this teaching approach will appear in Hess and Drew (2004).

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Concurrent Oral Presentations
Assessment/Learning Approaches
and Ethics

Tuesday – March 16

Moderator: Greg Newman

Bringing Back the Kaibab Deer Story: A Complete Case Study for Land Stewardship

Dan Binkley[1], Margaret M. Moore[2], William Romme[3] and Peter Brown[4]

The classic story of predator control, deer population explosion, and habitat degradation on the Kaibab Plateau was a cornerstone of population ecology and natural resources through the 1960s. The story has almost disappeared from natural resources, following several papers in the 1970s that questioned the quality of the evidence and the truth of the overall story. We reexamined the classic story from the viewpoint of habitat impacts of large deer populations; if the story were true, aspen regeneration should have been severely reduced in the 1920s. We also evaluated other lines of evidence, including the secondary irruption of the deer population in the 1950s. All evidence is consistent with the classic story of the role of predation in regulating deer population and limiting deer impact on vegetation. As with all complex ecological case studies, some uncertainty about causes and effects remains. The complete story of the Kaibab illustrates almost all facets of land stewardship: responsible goals, conflicts between agencies and between state and federal government, court-ordered resolutions, scientific uncertainty, long-term and spatially explicit ecological interactions, and even a cameo appearance from Hollywood and the popular press. The integration of all these themes provides both the details and the synthesis that form the heart of education in natural resources and land stewardship.

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Teaching Professional Codes of Ethics to Forestry and Wildlife Students: A Case Study Using Diameter-Limit Harvesting in a Bottomland Hardwood Stand

Brian Roy Lockhart[1] and Ralph D. Nyland[2]

ABSTRACT: Professional ethics involve statements by a professional organization to guide the behavior of its members, and to help them determine acceptable and unacceptable behavior in a given situation. Most, if not all, natural resource organizations have Code of Ethics. How to incorporate them across the curriculum and in individual courses of a natural resources program is a current challenge to faculty and administrators alike. We propose to capitalize on the role that professional ethics play in the daily activities of forestry and wildlife professionals engaged in hardwood resources management. Many hardwood stands today are subject to "selective harvesting" whereby trees of choice species and of the best quality are removed with little or no thought towards the future development of the stand or the benefits that landowners will derive from it (after Helms 1998). They are simply mined of the standing timber to the detriment of hardwood resource sustainability. A case study example relevant to the appropriateness of diameter-limit harvesting in a southern bottomland hardwood stand is presented as one way to integrate discussion of technical issues in forestry and wildlife management and professional ethics related to this practice. We propose its use in college and continuing education courses. Questions presented after the case study will help participants integrate knowledge of the ecology, silviculture, and management of bottomland hardwoods with the Code of Ethics of several professional organizations, including the Society of American Foresters and The Wildlife Society. Discussion of the issue will also help them to better appreciate the options for sustainable management of the bottomland hardwood resource.

INTRODUCTION

Professional codes of ethics are increasingly important in the everyday activities of natural resource managers, especially foresters and wildlife managers who have dual roles of dealing with forests and people. The days of working independently in the woods and relying principally on technical skills are over and will not return for most natural resource professionals. Today's foresters and wildlife managers now spend much of their time resolving complex management issues that involve people (e.g., certification, timber supply, land ownership disputes, mill demands, BMP

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compliance, hunting and fishing disputes, policy development) in addition to plying their skills related to day-to-day management of stands and forests. Professional codes of ethics play a key role in guiding these activities and in influencing their decisions. In fact, several state forester registration programs now require continuing education credits in ethics as a part of a forester's responsibility in maintaining their registration, e.g., Georgia (Field 1996) and Mississippi (http://www.cfr.msstate.edu/borf/cfe.asp).

We have observed that undergraduate programs in natural resources education have not historically kept pace with the need for teaching professional codes of ethics beyond an obligatory review in the first-year freshmen natural resource introductory course and junior/senior policy courses. And while natural resource programs have begun teaching professional codes of ethics (Lewis et al. 1998), faculty members often have difficulties in deciding how to teach these codes to students. Should they have students memorize then regurgitate the codes, attend guest speaker seminars, or use case study examples? These are but a few of the teaching methods utilized. The objectives of this paper are to briefly review the importance of teaching professional codes of ethics to undergraduate students and to argue the advantages of using a case study approach for teaching professional ethics using bottomland hardwood forests as an example. Our focus is on undergraduate forestry and wildlife students. However, the case study, associated questions, and teaching approaches can also be used in graduate courses and continuing education.

WHAT ARE PROFESSIONAL CODES OF ETHICS

Cunningham and Saigo (1990) described ethics as a branch of philosophy concerned with morals – the distinction between right and wrong, and values – the ultimate worth of actions or things. Coufal (1998) stated that values are the basis of ethics while Greenburg (2004) stated the essence of ethics is to go beyond what is required. Lammi (1968) distinguished between religion, morality, and ethics. He stated that the tenets of religion relate broadly to human life rather than specifically to professional conduct. Morals and morality are concerned with the rules and practices of conduct of an individual within a society – defined as laws. Ethics relate to individual conduct and group activity with respect to the goals of a particular profession to human society (Lammi 1968). Essentially, they represent the "do's" and "don't's" of a profession in broad, general terms (Coufal 2000).

A professional code of ethics serves to guide an individual's or group's behavior (Smyth 1995). Field (1996) stated that adherence to a code of ethics is one of the common characteristics of a profession. Another is that members must be formally educated. Codes of ethics generally are not designed to provide individuals with the right answers so much as to help them to ask the right questions (Banzhaf 1994). Codes of ethics in the natural resource professions can be thought of as the force that integrates a person's science background with the social and philosophical implications of a given natural resource issue. Professional ethics also encourage a humility among natural resource professionals. Codes of ethics help to prevent inappropriate conduct (Irland 1994b).

Lammi (1968) classified unethical conduct into three categories. Category 1 issues involve the deliberate choice to make an unethical decision. Lammi (1968) described this conduct as the "most abhorrent violations of ethics" and "morally despicable". The penalties can include expulsion from the professional ranks. Category 1 behavior can oftentimes be thought of as the "bad apple" example. Category 2 unethical conduct involves the lack of knowledge, i.e., a good faith effort to make a decision without full knowledge of the situation. Penalties often involve corrective actions, including payment of damages and requirement for remedial education. A strong professional curriculum in any natural resources field and continued learning beyond the time of graduation will usually alleviate potential Category 2 misconduct. Category 3 behaviors involve the lack of means (e.g., practices in limited resource countries) where policies and politics prevent or discourage proper conduct. Lammi (1968) stated that changes in policies, politics, and education help to alleviate the potential for Category 3 conduct.

A purview of the literature indicates that ethics has been discussed for many decades with reference to natural resources issues (Olmsted 1922, Chapman 1947, Chapman et al. 1948), but only recently have they been the focus of widespread discussion across natural resource disciplines (Irland 1994a, List 2000). The Society of American Foresters (SAF) and the Wildlife Society each have Professional Codes of Ethics, as do other natural resource professions. All evolved through years of debate and change. In fact, Kipnis and South (2000) stated that within a profession, its code of ethics is a collective undertaking by which practical wisdom is developed and employed – it is a living document that should be regularly reviewed and updated as needed. Yet Field (1996) stated that seldom is any thought given to improvements in ethical codes or to training in their application once they are established. On the contrary, the SAF has gone through several revisions in its professional Code of Ethics, the most recent being in 2000. The latest changes involved sections of the Code that were deemed ambiguous, redundant, too specific, or unnecessary (Radcliffe 2000).

Overall, professional codes of ethics encourage appropriate behavior within the natural resources professions. They also provide guidance for effective communication and collaboration among colleagues within the profession, and improve relationships with employers, clients, forest resource users, and the public in general (Lammi 1968). The latter two groups are particularly important as they can influence forest policy through contact with legislators, but may have little knowledge on the technical aspects of forestry and wildlife management (Lammi 1968). Coufal (1998) stated that without active involvement in ethical discussions, natural resource professionals are likely to march to the beat of drums played by others.

WHY TEACH PROFESSIONAL CODES OF ETHICS TO UNDERGRADUATE STUDENTS

The above arguments lead us to conclude that undergraduate students should be exposed early and often to the codes of ethics for their chosen profession and for other natural resource professions as well. Most students who enter college have already been exposed to concepts of ethics through life-learning experiences such as parental guidance, scouting, hunting and fishing sportsmanship, and high school athletics sportsmanship. Oftentimes though, they have not been formally introduced to professional ethics. This is important to:

1. introduce students to some of the philosophical aspects of their chosen profession (Lammi 1968),
2. expose students to real life situations in a safe setting,
3. teach students how to use guidelines to resolve ethical dilemmas,
4. help students learn how to ask the right questions in natural resource issues,
5. give students the opportunity to be interactive in classroom exercises,
6. engage students in controversial issues,
7. teach students that there may be more than one way to resolve ethical dilemmas,
8. teach students to display a decent respect for the conflicting views and values of others (Ireland 1994d), and
9. encourage students to continually ask: "What is the right thing to do?" (Coufal 1996).

McNeil (1998) argued that teaching professional ethics would help students: (1) gain confidence in dealing with ethical questions, (2) recognize and explore those questions, (3) appreciate moral dimensions of common issues and analyze positions of others, and (4) increase their "mental fluency" and ability to participate in public discussions over moral aspects of work. Furthermore, Coufal (1996) indicated that including the study of professional ethics in a curriculum helps students to more fully understand what it is they believe and to better justify their own values and ethics with those involved in natural resources management and use.

Field (1996) indicated that academia has failed to convey the importance of professional conduct to students and that this deficiency must be addressed. One approach is to teach ethical reflection (Irland 1994c). This involves reflective thought and discussions about upcoming issues. In the context of ethics, it enables students to identify potential problems early and helps them develop the ability to recognize available options for resolving a problem in a satisfactory manner (Irland 1994c). Irland (1994c) considered the development of ethical reflection a core professional skill that should be an integral part of all natural resources curricula. Adherence to ethical reflection may help a student to avoid ethical relativism or the blurring of right from wrong (Johnson 1989 from Irland 1994a). Ethical relativism involves the erosion of a person's sense of right and wrong in favor of a "no-fault" society. It is a threat to sound ethical judgement (Johnson 1989 from Irland 1994a).

Ladd (1979 from Irland 1994a) questioned whether a code of ethics is really needed. Those to whom a professional code of ethics is addressed and who need it most will not likely adhere to it anyway (such individuals are probably not even a member of the profession's organization). Others in the profession already know what they should do. Further, many respectable members of a profession regard its code of ethics as a joke and something not to be taken seriously. Yet teaching about codes of ethics to undergraduate students is a part of their professional maturation. Field (1996) pointed out that learning professional ethics is part of the life-long experience; that regular, systematic attention to ethics enhances the awareness of forestry and wildlife students to their professional obligations and to the ethical implications of their actions. To that end, we believe that students should have opportunities to learn about professional ethics throughout their entire undergraduate program.

A CASE STUDY

Background

Our experiences in forestry underscore the importance of professional ethics in modern hardwood management. The eastern United States supports a tremendous hardwood resource – from the northern and central hardwoods to the Appalachian hardwoods, and southward to the upland and bottomland southern hardwoods. Research and practice has provided much information about the sustainable management of these hardwood resources, as exemplified by several comprehensive hardwood management publications. These include Putnam's (1951) "Management of Bottomland Hardwoods", Putnam et al.'s (1960) "Management and Inventory of Southern Hardwoods", Walker and Watterston's (1972) "Silviculture of Southern Bottomland Hardwoods", Kellison et al.'s (1981) "A Guide for Regenerating and Managing Natural Stands of Southern Hardwoods", Hick's (1998) "Ecology and Management of Central Hardwood Forests", and the U.S. Forest Service's Northern Hardwood Notes (Hutchinson 1985) and Central Hardwood Notes (Clark and Hutchinson no date). Unfortunately, far too many forests are exploited by diameter-limit cutting harvesting under the guise of "selective management". This has had considerable short- and long-term negative impacts on the hardwood resource and the potential for landowners to sustain the critical values that hardwood forests can provide for future generations (Nyland et al. 1993, Fajvan et al. 1998, Nyland 2001).

What is Diameter-Limit Harvesting?

Diameter-limit harvesting usually involves removing trees larger than a specified diameter (d.b.h.), with little or no thought to the composition and structure of the residual stand, or any deliberate effort to regenerate a new age class (Nyland 2002). Past thinking (and unfortunately much present thinking), especially with respect to bottomland hardwood ecosystems, suggests that the smaller trees, regardless of quality, vigor, or even species, will grow to replace the harvested trees. Stand development studies clearly show

many bottomland hardwoods growing on moist sites resulted from natural reforestation in either old fields or after major disturbances that resulted in stratified even-aged stands (Oliver 1978, Clatterbuck and Hodges 1988, Ashton and Peters 1999). Diameter distributions in mature mixed-species hardwood stands will typically show a reverse-J shaped curve, a situation often considered representative of uneven-aged stands. But these diameter distributions should be broken down to the species level (Ashton and Peters 1999). That would show that within many bottomland hardwood stands the diameter distribution for each species may plot out as a bell-shaped curve, with each one covering a different spread of diameters. Among stratified mixed-species stands, these tend to overlap to form a reverse-J distribution for the stand as a whole (Oliver and Larson 1996). Thus in bottomland hardwood stands, the oaks (Quercus spp.) and green ash (Fraxinus pennsylvanica Marsh.) will typically have the largest diameters, sweetgum (Liquidambar styraciflua L.) and red maple (Acer rubrum L.) the intermediate sizes, and shade-tolerant species such as American hornbeam (Carpinus caroliniana L.), eastern hophornbeam [Ostrya virginiana (Mill.) K. Koch], and flowering dogwood (Cornus florida L.) comprise the smaller diameter classes. Removing the largest trees (oaks and green ash) will release poorer-quality (and assumed genetically inferior) oaks and green ash, along with the more shade-tolerant species having less desirable characteristics (Clatterbuck and Meadows 1993). These may interfere with the regeneration of new oaks and green ash, especially if repeated diameter-limit cutting removes the seed source.

In some cases, one diameter-limit harvest may not be totally detrimental to the future development of the stand. If large diameter trees co-exist with smaller acceptable growing stock of a desired species, then removal of the larger trees releases the smaller ones and they may develop into acceptable trees at some future time. Such conditions often followed a past disturbance that partially opened the overstory, leading to regeneration of a second age class beneath the older upper stratum. Diameter-limit harvesting has also been used when the shade-tolerant species that develop in the lower stratum of an even-aged stand are good quality trees with sufficient vigor to respond to the release [e.g., released overtopped sugar maple (A. saccharum Marsh.] from beneath an overstory of shade-intolerant species of high commercial value (Reed et al. 1986, Erickson et al. 1990). Yet this release has the greatest benefit when linked to supplemental tending (thinning) of the smaller diameter classes (Bodine 2000). Unfortunately, no shade-tolerant species in southern bottomland hardwood forests are considered to be both high-quality timber trees and useful components of wildlife habitat, so releasing it by diameter-limit harvesting provides little economic benefit to a landowner. Diameter-limit harvesting has also been considered acceptable when the management objective calls for the promotion of specific shade-tolerant species, such as sugarberry (Celtis laevigata L.), boxelder (A. negundo L.), or red maple. While not common as a management objective, promoting these species may serve a specific purpose in wildlife habitat management.

Despite these possible exceptions, diameter-limit harvesting (often called selective management or selective harvesting) usually represents the antithesis of good hardwood management. Repeated diameter-limit harvesting degrades the hardwood forests, does not optimize the long-term production potential of stands, and is often simply outright

high-grading. This "management style", or exploitation, represents the greed associated with a philosophy of maximizing short-term profit with a minimum investment (Nyland 1992). Coufal (2000) stated that "This situation is made complex because the public probably prefers the appearance of a high-graded stand to a clearcut, and the high grading often meets the immediate needs of the landowner." Yet repeated diameter-limit harvesting in hardwood stands is poor land stewardship.

The Case Study – "Diameter-Limit Cutting – Short-Term Gain at a Long-Term Loss"

The case study "Diameter-Limit Harvesting – Short-Term Gain at a Long-Term Loss" is adapted from the SAF's ethics guide titled "Ethics Guide for Foresters and Other Natural Resource Professionals" (SAF 1996). We modified it for conditions in southern bottomland hardwood forests. Students should read the introductory statement that outlines the situation in a general sense, as follows. Then they will consider a specific case like the one illustrated below. Through discussions they explore the issue, and consider how they might respond with respect to the Code of Ethics developed by the SAF and The Wildlife Society.

The Situation

Throughout the latter half of the 1900s vast acreages of second-growth hardwoods developed into sawtimber size across much of the southern United States. These stands became established following heavy liquidation harvests in the early 1900s, as well as from natural reforestation of abandoned agricultural fields.

While the market for poor-quality and small-diameter trees has been limited, the export market for logs and lumber of a variety of choice species has grown. This presented an opportunity to sawmills to profitably ship lumber from prime hardwoods [oaks, yellow-poplar (Liriodendron tulipifera L.), cottonwood (Populus deltoides Bartr. ex Marsh.), green ash, and sweet pecan (Carya illinoensis (Wangenh.) K. Kock)] abroad. To get sufficient raw material to capitalize on the new markets, they raised stumpage prices for choice species.

Many landowners responded to the new opportunities by increasing sawtimber sales from their forests. In many cases, their interest in silvicultural practices aimed at producing quality hardwoods shifted toward simply taking out the biggest and best trees (the valuable ones), and leaving behind depleted and poorly-stocked stands with insufficient growing stock to sustain high levels of future production. At best, the harvesting was a bit less severe than out-and-out high-grading.

The Case

You are a forestry consultant in the southern United States, in an area where the conditions described above prevail. Although you have known that diameter-limit harvests are not part of "accepted silvicultural practices," you have used the method in private forests when landowners insisted on minimal costs and maximum returns. You did this because the practice has been common in the area; because if you did not do it, a competitor would; and because you believed that you could, at least, soften the impact of the practice by laying out proper skid trails and haul roads, and minimizing site disruption. Further, your belief was that the diameter-limit harvests, while not the best practice, were not significantly damaging the forest over the long term.

In reading your professional journals and other sources of information, you find arguments that discredit this latter belief. Research is now indicating that diameter-limit harvests being applied under recent and current market conditions portend a long-term conversion in the composition of stands, resulting in lower market values and decreasing other landowner benefits for the future. Also, diameter-limit harvesting leaves poorly stocked stands having an irregular distribution of residual trees, and it makes no effort to tend the residual size classes to upgrade their quality or enhance their growth. Over the long term, diameter-limit harvests tend to result in residual stands of poor-quality stems, with less desirable species and genetically inferior individuals, having variable stocking and crown cover, and lacking desirable seed sources.

A landowner, who owns 200 acres of bottomland hardwoods, has asked you to provide consulting services. He learned about you through a friend, for whom you worked several years earlier when you laid out and supervised a diameter-limit harvest. Your potential new client has 124 acres of high-quality mixed hardwoods he wants harvested. Wanting to take full advantage of the current market, he asks you to lay out and supervise a diameter-limit harvesting on a commission basis. With your new knowledge of the long-term implications of such harvesting practices in bottomland hardwood forests, what do you do?

Following Through With Discussion and Questions

We believe the case mentioned above represents a common ethical challenge to foresters and wildlife managers who work throughout the eastern and southern hardwood forests. The following questions are to generate thoughts and discussion about the ethical implications of the proceeding with a diameter-limit harvest in this case, and more broadly about the implications of diameter-limit harvesting in bottomland hardwood forests.

1. Over the past several years, forestry professionals have talked about forest stewardship and developed catchy "bumper-sticker" slogans, such as "Trees Are America's Renewable Resource," "For a Forester, Every Day is Earth Day," and

"A Healthy Forest Is No Accident". Foresters have also developed land ethics statements and principles of sustainable forestry, and promoted them within the profession and to a variety of publics. Few, however, have spoken out against diameter-limit and species-removal harvesting; in fact, many have encouraged such sales without question.

A: What are the likely long-term effects on the forestry profession when actions do not match the rhetoric?

A: What are the likely long-term effects on the wildlife profession?

A: Under which of Lammi's (1968) unethical categories does this case example fall?

2. What guidance do the individual Principles and Pledges in the SAF's Code of Ethics, and statements in the Preamble in particular, give to you when faced with a decision about responding to this landowner? What Principles and Pledges in particular seem applicable, and how? [The SAF Code of Ethics can be found at http://www.safnet.org/who/ethics.htm]

3. What guidance do the individual canons in The Wildlife Society's Code of Ethics give to you in this case? [The Wildlife Society Code of Ethics can be found at http://www.wildlife.org/about/index.cfm?tname=bylaws]

4. How do best management practices (BMPs) for your state address diameter-limit or selective harvesting? You may find that most, if not all, state BMP guidelines do not explicitly address diameter-limit harvesting. In that case, should state BMP guidelines be amended to address the issue? Or is that the responsibility of each practitioner?

5. Presume that you advised this landowner about the likely long-term, negative effects of the proposed diameter-limit harvest, but he decides to proceed anyway. Should you do more in trying to dissuade the landowner? What more can you say to him about better alternatives? Do you decline the consulting job if he insists on doing it anyway? Why or why not?

   Note: In discussions with students about whether to proceed or decline the job, remind them of their pending graduation and that they will need to support themselves and a family. Ask the student how would they respond if this landowner has an immediate need for money to pay emergency medical expenses.

6. Presume that you decline the job, and later you learn that a competitor has taken it on and does a diameter-limit harvest for the landowner. What do you do, and why? Which SAF Principles and Pledges in particular apply to this question and question 5? Which Wildlife Society Canons apply?

7. You have discussed the implications of diameter-limit harvesting with a Society of American Forester member who is a certified forester and the owner of a local sawmill. He has the opportunity to bid for the logs coming off the property. What would you say to him? What should he do and why?

8. Assume that the landowner and the mill are Forest Stewardship Council and Sustainable Forestry Initiative certified. How does the proposed diameter-limit harvesting affect certification? What should you do about it?

9. Given that this case involves bottomland hardwoods, what is the likely consequence of repeated diameter-limit harvesting practices on species composition, stand structure, and the long-term production potential?

10. One commonly accepted concept in natural resources management says: "Any type of forest harvesting is both good and detrimental to wildlife habitat, depending on the wildlife species". Then how can diameter-limit harvesting enhance wildlife habitat? How can it be detrimental to wildlife habitat?

11. How would you advise a potential client, who is considering diameter-limit harvesting in a bottomland hardwood stand? What factors would you include in outlining the negative effects, and any possible benefits to the landowner?

Other Questions to Consider

Besides providing an opportunity to discuss ethical issues related to professional practice, this case also encourages students to review the technical aspects of silviculture, forestry economics, forest management principles, wildlife management, and related matters. Other questions that will broaden the discussion even more include:

1. Are there state or local laws or regulations (best management practices, clean water laws, right-to-harvest laws, etc.) that are pertinent to the type of harvesting practices used in bottomland hardwoods? How do they relate to your personal and professional ethical responsibilities, particularly with reference to the Society of American Foresters' Code of Ethics?

2. How does this case illustrate the differences between laws and ethics?

3. Should professionals be held to their ethical codes of conduct in legal proceedings? If not, how are professionals held accountable for their actions in cases related to the harvesting practices that they recommend and use in their business?

APPLICATION OF THE CASE STUDY

The key to using the diameter-limit harvesting case study in teaching ethics, or really any subject, is to make the learning experience natural and fun for undergraduate students by promoting curiosity, exploration, and knowledge-sharing (Moen 2002). Several approaches can be used. Preferably the case study is offered to students at the junior and senior levels, who can use prior knowledge of concepts about the ecology of bottomland hardwoods as found in Hodges (1997) and Lockhart et al. (In press) and from their studies in silviculture and wildlife management. That will insure a meaningful linkage between their appreciation of those technical fields, and an awareness of the importance of ethical behavior to natural resources professionals.

In teaching this case study, the instructor might divide students into teams of four people during one laboratory period. The goal of this group format, in addition to having the students address the questions posed above, would be to develop a cooperative learning environment. Knuth (1996) stated that use of student teams helps them to incorporate important concepts into their knowledge base. A field trip to visit several stands recently harvested by diameter limit and more appropriate methods would help to enliven the conversations by providing a common experience that the class could discuss in comparing and contrasting the different approaches. Unfortunately, it is usually not difficult to find recent examples of exploitative practices. Ideally, the field trip would include recently harvested stands showing appropriate and inappropriate practices, and others at least 10 years since the harvest to demonstrate the longer-term effects of diameter-limit harvesting. After the field visits, teams would meet to discuss the questions presented above, and to consider other thoughts raised during their discussions. Each team would summarize their conclusions into a 10-minute PowerPoint® presentation to share with the rest of the class. In this way, each team would be reviewing perspectives not posed by other teams. During the presentations, each team would be questioned by the other students for about 5-10 minutes. The instructor would interact as needed, but would primarily observe each team's presentation and interaction with the other students.

This approach could take two laboratory periods. But student discussion and enthusiasm could be heightened if done in a single laboratory period while the students still have a vivid recall about what they saw during the field trip. Either way, the case study approach requires students to integrate information from other courses (e.g., dendrology, silvics, forest ecology, and measurements of trees and wildlife habitat). Furthermore, it engages students in a group activity of the kind that seems to benefit young people in today's technologically advanced society (Moen 2002).

A second approach to presenting this case study, and one that we have not used, is to split students into two teams for a debate. One team would present the "positive" sides of diameter-limit harvesting in hardwoods while the other would present the "negative" sides. As observed in the forest policy course in the School of Forest Resources, University of Arkansas – Monticello, the university's debate team could coach the students on how to frame their arguments to insure an effective debate. The laboratory

trip would still be beneficial so students can gather information, including pictures, for use in presenting their case. Peers and other faculty and staff could be invited to hear the debate and raise questions to the teams, thus extending the learning experience to other members of the campus community. A subset of the university's debate team, those not involved in coaching the students, could serve as the judges. Besides giving students the opportunity to practice oral communication in a public forum, this approach requires students, especially those arguing the pros of diameter-limit harvesting, to examine both sides of the issue while exploring the ethical dilemmas posed in the questions related to the situation. We believe the learning atmosphere presented by a debate would likely be more effective as a learning experience than if a faculty member simply lectures about the negative effects of inappropriate harvesting practices in bottomland hardwoods.

The use of a case study, such as the diameter-limit harvesting example, promotes a high level of interaction between students and the instructor (Webber and Crews 1998). Little time is spent on lecturing, testing, and grading. More time is spent on leading, mentoring, offering constructive criticism, and evaluation (Webber and Crews 1998). Whether incorporating a team presentation or a debate, this case study requires students to consider professional ethics in a philosophical framework for decision making as well as in a context representing the environment for real decisions in professional work (Lewis et al. 1998).

The case study can be taken one step further in a future exercise where students are required to prescribe a rehabilitation treatment for a high-graded stand. This next logical step would require students to use their studies in silviculture, particularly the artistic side of silviculture, to alleviate one of the most complex technical challenges of hardwood management. This additional exercise also would help students prepare for the time when landowners, who have high-graded hardwood stands, seek their professional assistance in finding a remedy for the dilemma.

The use of case studies does have potential pitfalls. Rashad (1994) pointed out that case studies are not effective when students have difficulty conceptualizing the problem to be solved, especially if they had little or no training in problem-solving. This shortfall can be resolved by ensuring that upper-level undergraduate students review pertinent materials prior to engaging in the case study. The laboratory trip is especially important in helping them to appreciate the implications of diameter-limit harvesting and the short- and long-term effects it has on the hardwood resource in bottomland forests.

SUMMARY

Major newspapers and television news programs include daily examples of ethical misconduct. It is imperative upon university administrators and faculty to press their students to consider professional ethics early and often in each student's academic life. Exploration of professional ethics should be formally incorporated into every course of a professional nature in natural resources curricula (Coufal 1996). Further, attention to professional ethics should go far beyond the basic statements regarding professional

behavior, cheating, plagiarism and the customary professional conduct policy that faculty members routinely write into course syllabi. Irland (1994c) suggested that faculty members treat ethics as a key professional skill that students must continually deal with, and not isolate it as a formal component of only selected courses. A periodic review of applicable codes of ethics should involve case studies and discussion of recent situations, even if they are only somewhat related to natural resources. Irland (1994c) further suggested that faculty and students alike continue to ask the question, "Is this ethical?" as a way to reinforce professional ethics. The diameter-limit harvesting case study and teaching approaches that we suggest represent but one small component of an across-the-curriculum approach to incorporating a study of ethics into natural resources education.

We used the diameter-limit harvesting to illustrate the case study approach based on our experiences in teaching hardwood silviculture and working with landowners who have needed to make important choices about the way to manage their forests. Diameter-limit harvesting, or outright high-grading, is still far too common in hardwood forests of North America. We hope to encourage two things – to promote increased teaching of professional ethics in forestry and wildlife management education, and to encourage the cessation of high-grading in hardwood stands. A hardwood forester who wished to remain anonymous recently said it well:

"Do not exploit the hardwood resource – it is what got us here and it is what will provide for us in the future."

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Useful Concepts and Approaches to Ethics in Natural Resources Management

John D. Fox, Jr.[1]

ABSTRACT: My objective in this paper is to highlight a few concepts and approaches from ethics that might serve as food for thought when students are wrestling with controversial natural resource issues. Overall, I'm advocating critical reflection, empirical inquiry, and intellectual honesty. I am particularly going to look at the interrelationship between science and ethics. I suspect not everyone will agree with everything I suggest, but, as in the classroom, my purpose is to stimulate thought and dialogue. First, I present some basic concepts followed by a simplified summary of classical approaches to ethics. Finally, I suggest that Aldo Leopold's land ethic has been misinterpreted by some of his modern disciples.

INTRODUCTION

The Natural Resources Management program at the University of Alaska Fairbanks strives to instill the intellectual virtues of critical reflection, empirical inquiry, and intellectual honesty in the context of producing a technically competent and ethically responsible professional (see Wilson, 1999 for details on these intellectual virtues). My objective is to highlight a few concepts and approaches from ethics that might encourage these virtues as food for thought when wrestling with natural resource issues. I am particularly going to touch on the interrelationship between science and ethics. I suspect not all will agree with everything I say, but I hope it might launch you into ethical dialogue.

USEFUL CONCEPTS

First of all, science and ethics are very much interdependent fields of human endeavor. Ethics without science is at best uninformed and at worst delusive, while science without ethics is at best unguided and at worst downright dangerous. Perhaps the clearest principle regarding the relationship between science and ethics is "ought" implies "can". "Stop continental drift" cannot be an ethical mandate! While one might pontificate that we "ought" to stop the "homogenization" of the world's ecosystems or cultures, it may be something we just cannot prevent. In a broader context, Kenneth Boulding (unknown) said: "The most worrying thing about the earth is that there seems to be no way of preventing it from becoming one world."

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While "ought" implies "can", the inverse is not true. "Can" does not imply "ought." Obviously, we could transform the boreal forest into a vast tree farm. But, that doesn't automatically mean we should. Of course, "can" does imply a choice, and not everyone will choose the same path. To understand human nature is to understand the difficulty of saying "no" to "can".

Another very important concept is captured by the words **"is" does not imply "ought."** Just because something "is" a certain way scientifically or factually, does not mean it ought to be that way in an ethical sense. There are many forms of this principle and related ideas. David Hume (1740) noted the logical fallacy of deriving an "ought" conclusion from purely factual premises – the so-called **"is-ought"** dichotomy. G.E. Moore (1903) coined the term **"naturalistic fallacy"** to reiterate that we cannot substitute any single natural or empirically verifiable term for our meaning of "good". "Good" means what we mean by "good"! "Good" is a fundamental, intuitive, and unique concept that cannot be broken down into something else. He applied this principle to argue against Herbert Spencer's "social Darwinism" that equated "good" with "survival". Likewise, today one cannot substitute ideas such as "productivity", "bio-diversity", or "sustainability" to encompass the full meaning of the word "good". In spite of this, we continue to see signs of such "naturalistic fallacy" frequently in ecology and ecosystem management from folks who, I would argue, purport to be dealing only with the facts (scientists). Old growth forests are somehow deemed good or better than early successional forests. Native species are somehow "good" while non-native species are "bad". Such proclamations often take on the air of normative statements. Some seem to go to great efforts to avoid acknowledging that the concern over nature is really instrumental to personal or social welfare. The implication or direct claim that humans should behave in a certain way because it is "good for the ecosystem" is unclear thinking unless a specific link to human welfare is made. Contrary to popular rhetoric, the ecosystem isn't an entity that has "interests" per se, that can be fostered or subverted. **Ecosystems are not idealizations, they are realizations!** It seems sometimes we aspire to find or define the perfect ecosystem – one that sustains the production of some natural condition that is being subconsciously substituted conceptually for "good". Perhaps we could call this the "Shangri-La Syndrome" or the "Garden of Eden Syndrome"! What ever one calls it, it is a case of the naturalistic fallacy, at least if it is not acknowledged that by "good" we mean what is good for humans, living now or in the future.

Both science and ethics derive in humans from the same intellectual capabilities: ability to wonder, the ability to imagine alternative actions, the ability to project their possible consequences, and the ability to evaluate and choose among alternatives. But it is important not to confuse the realm of fact with the realm of value. Although the realm of fact informs the realm of value, scientists have no greater qualifications to make value judgments outside the realm of science, than others. In fact, scientists accept the challenge to remain objective when acting in that role, recognizing they, like non-scientists, have their own personal values. We certainly don't want to institutionalize a fuzzy boundary between fact and value by the language we use in science. Under the haze of ecological anthropomorphism it may be all too easy to mistakenly locate "good"

in the ecosystem and then relinquish ethical decision-making to the technical expert or scientist. I would strongly caution against that!

There are no "rights" in nature! While this may be viewed as a bold and radical statement, I would argue that the concept of rights is a uniquely human construct invented by humans, albeit, based on "human nature". Rights, so defined, assume equality with, reciprocity from, and responsibilities to other human beings. I do not argue that human beings, as moral agents, do not have duties to entities other than moral agents – I just don't think "rights" is the appropriate, logically consistent vehicle to express or implement this concept. Or, in other words, one cannot have rights without duties, but one can have duties without rights. A common device in environmental ethics books is the "last person" thought experiment. Here one asks would it be morally wrong for the last human being on earth to willfully destroy the biosphere as his last act. I propose another thought experiment for those who advocate "rights" for animals, trees, ecosystems, etc., -- imagine there are no human beings on earth, would "rights" exist in any meaningful and operational way?

TRADITIONAL APPROACHES TO ETHICS

Once we have chewed on these basic ideas we are still faced with the problem of choosing what to do. Do we all have to become philosophers in order to make ethical decisions? No, we do not; at least not in an academic sense. Remember, just because one might have a Ph.D. in Ethics doesn't make one ethical! Yet, we all can become better thinkers and better at ethical analysis. Mortimer Adler (1991) expresses Aristotle's insight when he says the ethical person is one who has "the habit of right desire", implying that we can develop through coaching and practice the skills necessary for ethical thinking. So, let's look at a few approaches to ethics as simplified by Marvin Brown (2003). He recognizes three approaches that we use in everyday life and suggests we invoke all of them in performing an ethical analysis.

One approach to ethics he calls the **"Ethics of Consequences"**. Here one focuses on the actual or projected results of an action or proposal. This is certainly relevant to our topic and places a fairly heavy emphasis on "science" to assess the feasibility and consequences of a proposal. Based on the "utilitarian" approach of Jeremy Bentham and John Stuart Mill, and applied by Gifford Pinchot, it has become a dominant theme in the assessment of public policy through economic cost-benefit analysis and more recently risk analysis. The ethical concept here is maximum "happiness", "welfare", or "utility" and is traditionally characterized by the phrase "the greatest good for the greatest number."

A second approach to ethics Brown calls the **"Ethics of Principle"**. Sometimes we need to focus on the act itself, regardless of the consequences. Has some ethical principle been violated? Usually this approach recognizes limits to "the greatest good for the greatest number" as society defends personal freedoms and rights against the potential tyranny of

the majority. The ethics of principle focuses on mutual respect and might be characterized as "the golden rule". Concepts of "justice" and "fairness" weigh heavily here.

A third approach to ethics is called the **"Ethics of Purpose"**. Here one focuses on the person (or agency) doing the act and asks whether it is consistent with his or her (or agency's) role at the time, or the fulfillment of their purpose. Does the actor have special responsibilities by virtue of his/her purpose in the context of the issue? We all play multiple roles in life. I might be judged based on being a father, a spouse, a teacher, a forester, or a friend. This approach is the foundation for professional codes of ethics associated with special duties or responsibilities willingly assumed by those with special training and commitment.

ENVIRONMENTAL ETHICS

What about the environment, environmental ethics, land ethics, Aldo Leopold? Certainly, there are many competing ideas on the appropriate theoretical foundation for an "environmental ethic". They all have strengths and weaknesses when applied to environmental issues. Let's look at it this way -- ethics are about relationships – relationships with ourselves, other individual human beings, our community and its institutions, other living beings, perhaps with a believed higher power, and, as more recently recognized, with our physical and biological environment. I contend that if you take human beings, as social animals, put them together in a given place or environmental setting, add "time", you will get what we call "culture". I particularly like the point of view of Gerlach and Bengston (1994) who said:

"Humans interact with nature primarily through culture (socially constructed and shared adaptive strategies and underlying values), and social structures (the expressions of these strategies and values in action and organization)."

The science of ecology helps us to identify and understand our relationships with our physical and biological environment, to illuminate the interdependencies, to identify and project the consequences of our actions on that relationship. However, because both ecology and ethics focus on relationships, it may be all too easy not to recognize when one has crossed the boundary between fact and value. The science of ecology describes, tries to understand, and attempts to predict the consequences of change; but it does not judge. Human beings must recognize and then be responsible for, their relationship with the biotic and abiotic environment. My relationship with my wife, my children, my dog, my community can be described, documented as to its change over time, and even explained by psychologists, sociologists, and anthropologists. However, an ethical judgment of me in those relationships must bring the multidimensional world of ethical concepts (intuitive, interpersonal, communal, and perhaps religious) to bear. If my action affects the pattern of my relationship with the above in light of such concepts as justice, welfare, respect, and duty, I can then be subject to ethical judgment.

I think one of the biggest pitfalls of environmental ethics is the naturalistic fallacy. We are led to believe there is some ideal condition of the ecosystem that represents how the world "should be" (usually as uninfluenced by humans), that can then be used as a reference point to strive for, maintain, or restore. Modern ecosystem management focuses on the "condition" of the system rather than on outputs, and we casually accept the notion of "ecosystem health", as if an ecosystem had an ideal state. I claim that much of this is anthropomorphism, argument by analogy, and dangerous flirtation with the naturalistic fallacy. Without critical reflection, empirical inquiry, and intellectual honesty, metaphors can replace clear thinking and lead to conceptual errors and foolish outcomes.

As good foresters and land managers you might ask "But what does Aldo Leopold say?". To some extent Aldo Leopold (1949) has led us down this path with his often quoted aphorism:

"A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise."

But, current science tells us that ecosystems are what they are: dynamic open systems more frequently than not in a state of disequilibrium and of which humans are a part (Pickett and Ostfeld, 1995). Callicott (1996), in light of this contemporary understanding of ecosystems, struggles to "update" Leopold's maxim. He says

"One hesitates to edit Leopold's elegant prose, but as a stab at formulating a dynamized summary moral maxim for the land ethic, I hazard the following: ' A thing is right when it tends to disturb the biotic community only at normal spatial and temporal scales. It is wrong when it tends otherwise.'"

So, was the eruption of Mt. St. Helens "wrong"? I believe Callicott's (1996) concern that Leopold's maxim needs updating reveals his misunderstanding in the first place. Leopold's words need updating only if one assumes that Leopold thought that stability, integrity and beauty were inherent properties of ecosystems as opposed to states of the ecosystem that humans desire, value and benefit from. Leopold knew that nature was dynamic! He knew humans were a member, albeit, "just plain member" of the biotic community. And, he certainly knew that beauty was in the eye of the beholder. Leopold as ecologist was, in many ways, ahead of his time and Leopold as ethicist revealed the "golden mean" approach of classical philosophers (see Leopold, 1932; Arnhart, 2000). He did not advocate the substitution of an "eco-centric" ethic for an "anthropocentric" ethic. He never even used those terms. He advocated a broadening of human interest to encompass the stability, integrity, and beauty of the biotic community. I think someone who got the spirit and philosophy of Leopold right, was the seldom quoted Joseph Wood Krutch

"Conservation is not enough… To live healthily and successfully on the land we must also live with it. We must be part not only of the human community, but of the whole community… It is not a sentimental but a grimly literal fact that unless we share this

terrestrial globe with creatures other than ourselves, we shall not be able to live on it for long…. You may if you like, think of this as a moral law. …If we do not permit the earth to produce beauty and joy, it will in the end not produce food either." (1955).

The problem and yet utility of ethics is that they tend to look at things in the long run and counter-balance our temptation to discount the future in favor of satisfying immediate needs or desires. Thomas Jefferson said: "The earth belongs in usufruct to the living." (Your assignment is to look up the meaning of the word "usufruct"!) Those living today must use nature to meet their needs, but must also consider their duties to future generations. This idea is fundamental to a stewardship approach to land ethics, relying heavily on the ethics of consequences as seen in the long-run, and the ethics of purpose by invoking our "role" as caretaker (by virtue of rationality and free will), and the ethics of principle constraining our actions by focusing on justice and respect for individual human beings, now and into the future.

ETHICS, RISK, AND THE PRECAUTIONARY PRINCIPLE

Ethics, in a way, can also be viewed as a qualitative risk analysis! It is a major way of dealing with uncertainty. This is particularly challenging, however, in the midst of rapid social, technological, and environmental change. Consequently, even ethical prescriptions themselves need to reflect a balance between blindly accepting conventional wisdom on the one hand, and summarily rejecting it on the other. That is why analysis is called for. Related to this later point, the concept of "the precautionary principle" has emerged and has been adopted by some engaged in environmental and natural resource debates. One definition was put forth at the Wingspread Conference in Racine, Wisconsin in 1998:

"When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically." (as cited by Appell, 2001)

This principle has so captured the imagination of people that there has been a separate conference dedicated to it (see: http://www.cid.harvard.edu/cidbiotech/bioconfpp/). David Ropiek and George Gray (2002) point out two contrasting views. They cite Edmund Burke, the 18th century British politician, as saying "Early and provident fear is the mother of safety", ie., "It's better to be safe than sorry!". They also cite American essayist Randolph Bourne in 1913 as saying: "We can easily become as much slaves to precaution as we can to fear. Although we can never rivet our fortune so tight as to make it impregnable, we may by our excessive prudence squeeze out of the life that we are guarding so anxiously all the adventurous quality that makes it worth living." It seems to me that rigid or extreme application of precaution advocates a "do nothing until everything is known" strategy. If followed, one would never get out of bed in the morning! A more common sense interpretation would suggest that when faced with uncertainty, take precautions against undesirable outcomes. This approach to precaution seems to at least presuppose an action will be taken.

CONCLUSIONS: MEANS AND ENDS

The role of the scientist or technical expert is to suggest possible consequences of actions and help attach probabilities to alternative futures. The role of the scientist or technical expert is not, however, to make the final decision by setting thresholds of acceptable risk, or by injecting personal ethical weighting factors in the summing of positive and negative consequences. That is the role of ethics as reflected in public policy, as manifested through public input, and as dictated by public and personal "purposes". The ethics of consequences, the ethics of principle, and the ethics of purpose all enter into public and private decision-making. A final thought on ethical decision-making is not to confuse means and ends. One should not use cost/benefit analysis or risk analysis to determine ends (see Sagoff, 1988, 2003). These are appropriate analyses to help choose efficient or effective means once a clear end has been determined. The determination of those ends, ie., what kind of world, what kind of environment, what kind of society do we wish to live in, obviously involves personal, social, and hopefully, ethical processes. Mortimer Adler (1991) reminds us that ethics is basically using the right means to accomplish good ends.

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Concurrent Oral Presentations
Learner-Centered Education

Tuesday – March 16

Moderator: Donald Arganbright

Environmental and Natural Resource Science and Learner-Centered, Integrative Education at Humboldt State University
Steven A. Carlson

Using the Engaged Student Approach in Wildland Recreation Classes
J. Mark Fly, (Presenter), Amy Mathis and Denise Keele

Outcomes Based Education, PBL and Kolb's Learning Cycle Help Forest Engineering Students Learn Forest Operations Planning…
Ted Needham, Ted Robak, Evelyn Richards, Dirk Jaeger, Neville Peasley and Jason Myers

Environmental and Natural Resource Science and Learner-Centered, Integrative Education at Humboldt State University

Steven A. Carlson[1]

Three recent workshops by three different organizations:

1. Project Kaleidoscope Assemblies, "Taking Advantage of New Opportunities for Environmental Sciences";

2. Renewable Natural Resources Foundation, "Conference on Personnel Trends, Education Policy, and Evolving Roles of Federal and State Natural Resources Agencies";

3. Association of American Colleges and Universities, "Achieving Greater Expectations" have synergistically made the compelling argument for integrative learning not only within the fabric of university education, but also within the specific realms of environmental science and natural resource education. This presentation will synthesize the workshop perspectives on integrative learning and look at how Humboldt State is moving to transform its curricula to produce more integrative, creative thinkers needed to deal with the complex environmental and natural resources issues of our world. The intent is to generate a discussion to help us solidify our thinking on curricular reform.

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Using the Engaged Student Approach in Wildland Recreation Classes Proposed Session: Learner-Centered Education

J. Mark Fly [1], Amy Mathis[2] and Denise Keele[3]

In the fall of 2000, the structure of the introductory class in Wildland Recreation (50 students) was revised from a more traditional approach to a blend of the "engaged student" and "mastery learning" approach. The "engaged student" approach is based on creating opportunities for the student to become involved with real world activities and make connections with professionals in the field while learning the basic concepts of recreation. The class is viewed as a job setting with similar expectations. The "engaged student" takes responsibility for their own learning, similar to what they need to do throughout their career with life-long learning. All students have to meet the minimum criteria of a test score of 85 or above on class lecture material. For some students this means they have to take the test multiple times or pass an oral exam. The students can choose to earn additional points needed by participating in field trips, practicums, a professional meeting or public participation sessions, conducting a park or resource problem analysis, and/or reading chapters from the textbook and responding to discussion questions in written format. Additional points can be earned by giving a presentation to class and attending guest lectures and student presentations. Early feedback on the course indicated that 71% of the students thought that they learned more with this alternative self-directed approach than they would have if the class had been taught in a traditional mode. Details of the procedures will be presented and the advantages and disadvantages discussed.

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Outcomes Based Education, PBL, and Kolb's Learning Cycle Combine to Help Forest Engineering Students Learn Forest Operations Planning, Project Management, Oral Communications, and Social Interaction

Ted Needham[1], Ted Robak[2], Evelyn Richards[3], Dirk Jaeger[4], Neville Peasley[5] and Jason Myers[6]

The ability to 'design and analyze natural resource management plans at multiple scales while adhering to principles of sustainability' is one of the learning outcomes of the Forest Engineering Program at the University of New Brunswick. One dimension of this outcome is the ability to design and analyze multi year operating plans. The purpose of this paper is to describe the teaching and learning approach used to help students acquire and demonstrate this ability.

FE 5780, "Forest Operations Planning Project', is a year long, team taught capstone course taken in the final year of a student's program. Using an outcomes based approach and problem based learning, the course is structured so students cycle through Kolb's learning cycle several times to develop and demonstrate competence in forest operations planning, and 4 professional abilities including oral communication, project management, and social interaction. While students work in teams and submit group reports, they also demonstrate competence individually through written reports, tests, and oral exams.

The teaching approach used in this course has evolved over the past 15 years and we expect continued refinement.

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Concurrent Oral Presentations/Workshop
Technology in Education

Tuesday – March 16

Moderator: Laura DeWald

Active Learning in a Web-based Introductory Course
Laura, E. Dewald

Developing and Teaching Asynchronous, Online Courses in Fisheries
Richard J. Strange

Using Technology for Integrating and Grading Diverse Writing Styles in a Large Writing: Intensive Introductory Environmental Science Course
Robert Boyd Harrison, A.B. Adams, Brian Strahm, Beth Liddell, Angela Costanzo, Eric Sucre, Julie Forcier, Kyle Petersen and Nick Johnson

Active Learning in a Web-Based Introductory Course

Laura E. Dewald[1]

The idea that people learn through knowledge reception is the most prevalent "common sense" assumption about learning and is the basis behind the lecture mode of instruction. In contrast, advocates of learner-centered education argue that learning occurs when meaningful knowledge is constructed by the learner being actively engaged with the learning material. Although many science-based classroom courses are using active-learning techniques, most web-based courses epitomize the passive method of instruction. Learner-centered education advocates maintain that merely to read or observe what is on a screen is not learning. They suggest that it is only when ideas are attached to existing frameworks in the students' minds that we can assert that learning has occurred. This requires reflection by the student; until the learner removes their gaze from the screen and is engaged in thinking, there is little learning likely to happen. Online teachers need to focus on ways they can interrupt the student's gaze and engage the student in mental exercises that help add new ideas to prior knowledge. In this presentation, I will describe methods of how I think I have encouraged student reflection, and stimulated critical thinking and writing using my web-based "Introduction to Forestry" course as an example. I will describe the course objectives, the student population taking the course, examples of active-learning exercises used in the course, and how I assess student learning and achievement of my course objectives.

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Developing and Teaching Asynchronous, Online Courses in Fisheries

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Asynchronous, online courses in fish physiology and recirculation aquaculture were developed using a standard html web site for delivery of content. The content was presented with text, Shockwave Flash (swf) animations, image mapped photographs, and streaming video. The text portions included an interactive glossary and assignments that were linked to the text at appropriate points for immediate access by the students. More than a hundred traditional scientific illustrations were brought to life thorough swf animation. Many of the animations included hot spot links to additional illustrations and the animations had speaking captions. In Fish Physiology, labs were presented using image mapped photos of dissected fish with interactive labels and pop-up image maps of photomicrographs. In Recirculation Aquaculture, lab material was presented in video clips and interactive simulations that were based on mathematical models. The web sites included links to the course management software Blackboard which was used primarily to for question/answer and threaded discussions of research papers. Students were assigned two "chapters" (web pages) a week and had a written assignment due each week which was submitted by email. There were a term papers, midterm and final exams. The exams were of the open-book, take-home type. Additionally, the students were required to participate in the discussions each week. Both courses were simultaneously offered at the upper division undergraduate and graduate level. Sample pages can be seen at: http://web.utk.edu/~rstrange/ by following appropriate links.

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Using Technology for Integrating and Grading Diverse Writing Styles in a Large Writing-Intensive Introductory Environmental Science Course

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Introduction to Environmental Science, ESC110, is one of the most popular courses taught at the University of Washington, with about 2000 students annually. Besides lectures and exams, course requirements include producing a large group project, individual-student peer review of the group project, rewrites and participation in an online discussion list. All of these assignments are organized and published on the internet. Grading of material is done directly from the published material, with grades and feedback also published on the internet. Students are encouraged to rewrite and improve their writing for higher grades. The ability to display all material from a single or multiple students at the same time, filter for plagiarism and check the "writing level" is extensively used to discourage copying of material from other sources. Due to the large amount of writing required and feedback from peers and teachers, students can elect to receive writing credit for this course toward their general degree requirements. The University of Washington is very culturally-diverse, and ESC110 represents a cross-section of all students and majors. Instructors have seen a definite culturally-related reluctance from some students to write and publish material in their own words, and a great deal of effort has been integrated into the course to encourage writing, peer-review of that writing, and improvement. The presentation will cover some of the approaches used to make sure students do their own writing, and how that writing is evaluated and feedback given.

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Concurrent Oral Presentations/Workshop
Experiential Learning

Tuesday – March 16

Moderator: Yeon-Su Kim

Building Professionally-Based Communities of Learning among Faculty, Students, and Practioners
Henry Campa, III, William W. Taylor, Scott R. Winterstein, and Alexandra B. Felix

A Peer-Review Teaching Tool for Graduate Term Papers
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Building Professionally-Based Communities of Learning among Faculty, Students, and Practioners

Henry Campa, III[1], William W. Taylor[2], Scott R. Winterstein[3] and Alexandra B. Felix[4]

ABSTRACT: Residential and non-residential "communities of learning" have been used within institutions of higher education as formal methods to enhance interactions among individuals that ultimately helps learning. Typically, these communities have included student-to-student and faculty-to-student interactions within residential living areas, teams in a core of courses, or teams of students within a course. If students are to develop into leaders within their respective disciplines an additional component that should be integrated into communities of learning is practioners. The objectives of our paper are to describe: 1) communities of learning and why they should be established for all students to enhance learning, 2) how to integrate a community of learning into its respective community of practice, 3) models of communities of learning and their characteristics, and 4) what roles natural resource practitioners, faculty, and students can play in developing and maintaining non-residential communities of learning to meet academic and professional objectives. Ultimately, the integration of faculty, students, and practioners for developing and maintaining learning communities will help create an educational culture that produces life-long learners and leaders in natural resources management.

INTRODUCTION-WHAT ARE COMMUNITIES OF LEARNING?

How students learn best and evolve into effective professionals have been questions that have always interested educators. However, what has been demonstrated by others is that when students are actively engaged with constructing knowledge, either independently or in groups, learning improves (e.g., Johnson et al. 1991). Because many natural resource management issues are often addressed with a team approach we advocate using communities of learning in higher education to help students develop into effective

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natural resource professionals. The objectives of our paper are to describe: 1) communities of learning and why they should be established for all students to enhance learning, 2) how to integrate a community of learning into its respective community of practice, 3) models of communities of learning and their characteristics, and 4) what roles natural resource practitioners, faculty, and students can play in developing and maintaining non-residential communities of learning to meet academic and professional objectives.

Communities of learning have been described as consisting of groups of students who work with faculty in a specified set of courses to meet specific learning objectives and experiences (e.g., L.C. Koch, Assoc. Vice Provost, University of Minnesota, personal communication, NC Teaching Workshop 2003). In essence, the community of learning concept is based on individuals participating in cooperative learning. Many communities of learning can be described as a residential model in which incoming groups of freshman are housed together and take a common group of classes. In this environment, there are facilitated opportunities for increased student-to-student and student-to-faculty interactions, increased cooperation and collaboration, meeting desired learning outcomes, and professional development.

The concept of a community of learning, however, can be expanded beyond what undergraduates in a residential model experience so that all undergraduate and graduate students can have the same learning opportunities. This expanded model, or more general approach of a community of learning, can be described by what Wenger et al. (2002) calls "communities of practice". A community of practice is "a group of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting…" (Wenger et al. 2002:4). In essence, a community of practice may describe participants in a club, professional society or students in a specific major—not necessarily just students in a residential community of learning. In this environment, individuals have the opportunity to experience that learning a "practice" (e.g., becoming a wildlife biologist) will involve becoming a member of a "community of practice". As individuals become members of a community they will have opportunities to understand the work, talk, ethics, and standards of a specific "practice".

WHY USE COMMUNITIES OF LEARNING?

Faculty Perspectives:

Clinchy (1990:123) argues that a student's search for knowledge is perhaps best attained through ongoing conversations "in which each person serves as a midwife to each other person's thoughts, and each builds on the other's ideas". In essence, this ongoing conversation about a common interest becomes a community of learning as individuals learn from one another and reflect upon their own ideas. However, if learning is to occur within a community of learners someone must be directing the conversations. Based on results publicized in Seven Principles of Good Practice in Undergraduate Education

(Chickering and Gamson 1987), students who frequently interact with their faculty members during college tend to be more satisfied with their educational experience and tend to drop out less. These findings may point to the fact that those students who are involved with others (e.g., faculty or practioners directing professional discussions) in learning environments may show more professional growth and development than those not engaged in communities of learning. For example, Bair and Haworth (1999; cited in Council of Graduate Schools 2004) documented that one attribute that was positively correlated to Ph.D. students completing degrees was the extent and quality of the student-advisor relationship. Given that Ph.D. completion rates range widely from 33.4% (Bowen and Rudenstine 1992) to 76% (Pion 2001 cited in Council of Graduate Schools 2004), being a member of a community of learning (i.e., including a good faculty mentor) may aid with enhancing retention and graduation rates.

Using various models of communities of learning to encourage cooperative interactions among students, faculty, and practioners will also be beneficial for preparing students to work in natural resources management teams as future professionals. Faculty should be encouraged to develop communities of learning that emulate the professional work atmosphere—this is how current and future problems will be addressed. When using communities of learning in this context it is important to convey to students that learning the issue is not as important as understanding the underlying concepts and process used to address the issue. Having communities of learning focus on the process of how to learn new information and solve problems will help them become life-long learners and tackle future issues.

Student Perspectives:

Everyone surely can think of a time where he or she suddenly had a great idea or insight that lead to development of a problem's solution, research proposal, enrollment in a course, or some other important step in that person's professional life. That idea, insight, or vision likely occurred because of some external stimulus. That is, a conversation with someone, a poster on the wall, a television program, or an article. In other words, something in the environment sparked a thought of idea that helped define a direction in someone's professional journey. This exchange of knowledge or flow of ideas cannot take place in isolation and this professional development depends on interactions with others within a community of learning.

Communities of learning within universities must occur at 2 levels—the curricular level and the professional level. At the curricular level, students need guidance, direction, dialogue, and support from communities to help plan a course of study that will be effective in facilitating skill development and experiences that will prepare students for future careers in the natural resources profession. Communities of learning are critical for student development because frequently students are unsure about what they want to do professionally, whether or not to pursue an advanced degree, or what elective courses they should take to strengthen their knowledge in a specialty area.

MODELS OF COMMUNITIES OF LEARNING AND THEIR CHARACTERISTICS

Communities of learning can occur under two models: residential and nonresidential. Two examples of residential models are the James Madison College (http://www.jmc.msu.edu/) and Lyman Briggs School (http://www.msu.edu/unit/lbs/) at Michigan State University (MSU). In the James Madison College, 200 freshman interested in policy related topics may enter annually, reside in the same residence hall, and stay in the four-year program. The Lyman Briggs School resides in the College of Natural Science at MSU and is also a four year program. Approximately 500 freshman enter Lyman Briggs annually, however, the School only maintains 1000 students, hence there is usually substantial turnover after students have been in the School for two years. Most students leaving Lyman Briggs seek majors in science-oriented departments. A limitation to the residential model of learning communities is that they are restricted to a relatively small number of individuals—what about other students who are not in residential programs but could benefit from the types of interactions and learning processes that occur in these communities of learning?

We advocate that a non-residential community of learning model composed of a hierarchy of communities developed across curricula, courses, and in mentoring programs could serve as alternatives or complement residential programs. At each of the three levels, faculty must strive to maintain the desired characteristics associated with communities of learning: facilitate interactions, bonding, and support systems; maintain personal and professional respect; mentoring opportunities with trust and flexibility to facilitate individual goals.

To meet the desired characteristics of learning communities within curricula a common set of courses (i.e., >2) must be connected with common themes (e.g., ecosystem management, quantification). Requiring students to take a sequential set of courses will promote a community and enable students to gradually build their level of expertise. At MSU, all fisheries and wildlife majors are required to take eight fisheries and wildlife courses. As Winterstein et al. (2001) describe, the sequence in which students should take these courses is designed to build their quantitative problem-solving skills. In essence, the courses include 3 nonexclusive groups, each with different educational goals (i.e., introduction to problem solving, tools for problem solving, and applications). Typically, students move through these courses in a cohort and are required to interact on various problem solving activities and assignments. Winterstein et al. (2001) discussed that the Department of Fisheries and Wildlife at MSU has not fully implemented the practice of having undergraduate students use a case study (e.g., bovine tuberculosis in free-ranging cevids) throughout core curriculum. Doing such, however, would facilitate cohorts of students addressing increasingly complex information, encourage them to learn more about an issue outside of classes, and seek information from practioners as they advance through their college career.

Experiential learning is another essential component of curricula that can be used within communities of learning to facilitate cooperative interactions among students, faculty, and practioners beyond the boundaries of classrooms. Giving students the option of meeting an "experiential learning requirement" by completing a field-based techniques course, study abroad program, or a professional academic internship could enable them to address real-life research or management issues in the field by interacting with faculty and practioners.

When developing curricula that will facilitate interactions among members of learning communities it is essential that they contain the educational foundation for a specific discipline. This foundation will help community members maintain an identity while simultaneously giving them the background to meet professional goals. For example, students desiring to be wildlife biologists may take courses in botany, chemistry, zoology, forestry, soil science, quantitative sciences, and natural resource policy and planning. Ryan and Campa (2000), however, mentioned that such a core will not be sufficient for preparing future natural resource professionals. Future professionals will need additional skills in oral and written communications, critical thinking, and problem solving. These three additional elements can easily be added into a curriculum using communities of learning and appropriate pedagogy to promote learner-centered, cooperative learning.

Formation of communities of learning must start in the classroom because the classroom is where students usually are first exposed to principles behind their chosen profession and are first introduced to individuals who will help them succeed in the profession. Educators can facilitate the desired characteristics of communities of learning within courses by using learner-centered pedagogy. To apply such approaches, however, will require faculty to engage students—and not rely on passive lectures. Courses that begin the semester with activities that allow students to network with other classmates and identify individuals with specific interests promotes connectivity and interactions with every participant in the class. For example, a 15-minute activity where each student has to meet individuals that identify with one of the statements from a list, such as find someone who has lived in California, or someone who has studied abroad.

Promoting student engagement, interactions, and cooperation seen in communities of learning can also be accomplished using problem-based learning (e.g., Ryan and Campa 2000, Ryan and Campa In Press). With problem-based learning, students may be encouraged to cooperate to address a real-life natural resource management problem (e.g., conducting a habitat analysis and management plan for biological diversity). In essence, a cooperative learning group becomes a community of learning. However, before they can determine how to address the problem they first must determine what new information needs to be learned. The process of determining what they need to know may require students to contact natural resource practioners and observe how practioners also struggle with the same process.

Giving cooperative student groups the opportunity to demonstrate how they addressed a problem is valuable learning experience. In essence, educators are giving them the opportunity to "learn to be" an actual natural resource practioner instead of having them "learn about" being a practioner (Bruner 1996). As educators, this is an important distinction as you decide what pedagogy to use to teach material and to communicate to students (Brown and Duguid 2002). Simply having students "learn about" (i.e., knowing about) being a natural resource practioner may only require them to accumulate facts and information and could be conveyed to them using passive lectures. "Learning to be" (i.e., knowing how) a natural resource management practioner, however, is more problematic for students and will require educators to use more sophisticated pedagogy (e.g., role playing, team-problem solving), however, the payoffs are great (Brown and Duguid 2002, Bruner 1996). Requiring student cooperative groups to address real-life problems in a problem-based learning context will promote interactions, involvement, and retention of information (Ryan and Campa 2000).

Effective mentoring programs can also be used to facilitate the desired faculty-to-students, practioners-to-students, and faculty-to-students-to-practioners interactions within communities of learning. The Council of Graduate School (2004) reported that student outcomes are influenced by financial resources, research experience, department environment, curriculum as well as mentoring. For example, Lovitts (2001) reported that graduate students who completed their degrees perceived that their advisors were more interested than those who did not complete degrees. Also, Preston (2003; cited in Council of Graduate Schools 2004) reported that 60% of the women graduate students who thought of themselves as "unmentored" completed their degrees in contrast to 100% of the women who thought they were mentored completed their degrees.

Having effective mentors (i.e., both faculty and practioners) is a critical element in non-residential communities of learning. Mentors can help guide learning of course material, facilitate professional development by helping students network, and help students understand the insider knowledge associated with a specific profession. Mentoring relationships, however, are not easily developed and will require trust from mentors and proteges as well as encouragement, support, and rewards from administrators for those who participate.

ROLES OF FACULTY, PRACTIONERS, STUDENTS IN DEVELOPING AND MAINTAINING COMMUNITIES OF LEARNING

Students feel that communities of learning should consist of members with 3 essential roles. First, peers are the foundation of communities of learning. Wenger et al. (2002) noted that effective communities provide an atmosphere of openness where members can informally explore ideas, insights, and experiences. This informal interaction, however, is critical for professional development. For example, students understand pressures, challenges, and opportunities that each other are facing because they are experiencing things together. They can work together, complain about things together, celebrate accomplishments together, discuss likes and dislikes about particular classes, make

mistakes and learn from them together. This part of the community is safe because they do not have to worry about their "image" or making a "bad impression" on any of the peer-members because everyone is at the same level; student peers are not the ones offering jobs or hiring graduate students.

Second, for students, the role of faculty in communities of learning is to initiate the flow of knowledge, be mentors and role models, and guide students toward finding pathways that will lead to fulfillment of their goals and aspirations. Although initiating the flow of knowledge can and should occur within the classroom, mentoring may be extended outside the classroom where the unique needs of each student can be identified and met. Office hours, one-on-one meetings, extracurricular activities through clubs, or informal chats on the way to class or when passing in the hallway are all good ways to maintain communities of learning.

Practioners also play a key role for students within communities of learning. Students need to interact with practioners to establish contacts, understand agency operations, keep updated on current issues and experience different viewpoints on natural resource-related issues. Practioners should also be encouraged to act as mentors and provide experience and direction for students.

CONCLUSIONS

Establishing communities of learning can be challenging, but the importance of them to strengthening university programs and enhancing student experiences is immeasurable. Students who get the most out of college, who grow the most academically, and who are happiest, have college experiences that include activities with faculty members or with several other students (Sharik and Wellman 2001). Similarly, faculty need interactions with students to receive feedback on course effectiveness and to know and understand student needs and goals in order to be good mentors and role models.

Students need to know that they are important as individuals and each has something unique to offer to a profession. Their difficulty, however, lies in discovering where their potentials lie and what factors motivate them to reach their fullest potential. Practioners and faculty are important in this process to provide additional opportunities to students for developing their skills and training to be leaders within a profession. The saying that the key to getting a job is "not what you know but who you know" has some truth. We think that residential and non-residential communities of learning (i.e., composed of students, faculty, practioners) help broaden "who you know" and provide the foundation for developing interpersonal skills, new insights and perspective, potential job opportunities, and direction for further exploration and professional development with professions.

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A Peer-Review Teaching Tool for Graduate Term Papers

Paul Beier[1]

I developed a writing exercise in which students act as peer-reviewers for each others' term papers. The students are provided with detailed instructions on how to conduct a review, and a copy of the rubric that the instructor will use to grade their peer review. Each student writes 2 formal peer reviews. The instructor acts in the role of an Associate Editor at a journal or a Program Officer at a funding agency, and provides a third review. The first draft is not graded – but the peer reviews are graded to a high standard and carry a combined point value 2/3 that of the final paper. The grade on the revised paper derives 10% from a formal point-by-point response letter and 90% from how well the author addressed each comment from the 3 reviewers (2 peers and instructor). The final grading is easy for the instructor, and most students get the rewarding experience of a well-deserved good grade for a paper that benefited from the peer review process. This tool has been used in 2 graduate classes at NAU, in conjunction with both traditional term papers and research proposals. Several students felt the exercise was their most valuable coursework experience at NAU. Instructors feel that the approach produces better papers. It was less successful in a senior-level undergraduate class. The grading burden on the instructor is shifted to the 9th and 10th week of the semester (reducing the end-semester crunch) and has trivial impact on total grading effort.

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Integrating Service-Learning into a Core Forestry Course: Forest Measurements, Modeling, and Inventory

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Service-Learning was integrated into a core course in the Forest Management Curriculum within the Department of Forestry at North Carolina State University: Forest Measurements, Modeling, and Inventory. The objective of the service-learning component of the course was to have the students research, design, implement, analyze, report, and reflect on the application of forest inventory and modeling techniques in conjunction with a service-learning community partner. The 'real-world' situations that the students encountered integrated the core course concepts and encouraged active learning, teamwork, and critical thinking. A local nonprofit organization, the Triangle Land Conservancy, served as the community partner for this endeavor. Articulated learnings, guided reflection sessions, and an online bulletin board facilitated the service-learning process. Each student participated in at least 25 hours of service work over the semester. At the end of the semester, each group formally presented the results of their service-learning project to the community partner and other stakeholders. An overview of the service-learning projects, inputs, outputs, evaluations, and recommendations for integrating service-learning into a natural resource measurements course are presented.

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Teaching and Assessing an Integrated Field Practicum for Forestry and Applied Ecology Majors

Linda Marie Nagel[1]

ABSTRACT: Field practicums (also known as field camps) have long been a traditional component of many university forestry curricula. Natural resource professionals need a balance of knowledge in multiple disciplines, as well as applied technical and communication skills. The field practicum at Michigan Tech, a cornerstone of the School's degree programs, has evolved in the courses offered, level of instruction, and the make-up of participants over the past decade. For the first time in 2003, students from two majors (forestry and applied ecology and environmental science), as well as graduate students and Peace Corps International students, took two different tracks at the camp simultaneously. Approximately two thirds of the credits are overlapping core courses and one third are major-specific. Courses taught by a group of instructors include multiple resource assessment, land measurements and GPS, wildlife habitat, forest health, insect ecology, geomorphology and vegetation, silviculture, and timber harvesting. The current structure of the field practicum involves a balance of classroom-style lecture, field-based instruction, field and laboratory exercises, and integrated group projects. Instructors are using a variety of active learning strategies, with varied success. The final assessment tool involves a complete land assessment and management plan prepared by small groups of students on a tract of land on the School Forest. This project requires competency, understanding, and integration across disciplines, and fosters teamwork skills. After the first year of integration of the two majors, the field practicum was deemed a success, with several areas of improvement identified. Some of the major challenges encountered revolve around balancing instruction to accommodate different student backgrounds and levels of experience, student dynamics in a residential field camp setting, and logistical coordination and integration of instructional material across distinct courses.

INTRODUCTION

The Department of Forestry at Michigan Tech was founded in 1936 with the first graduating class totaling 12 students in 1940. Enrollment in the forestry program has fluctuated over the years, with a peak enrollment of 722 in 1976, and a current enrollment of 123 undergraduates split between three majors: 68 forestry, 53 applied ecology and environmental science (AEES), and two wood science majors. The Department of Forestry became a component of the School of Forestry and Wood Products in 1968, and the School discontinued using the title Department of Forestry in 1983. In 2002, the name of the School was changed to the School of Forest Resources and Environmental Science (SFRES), better reflecting the degrees offered and the direction of natural

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resource sciences nation-wide. The curriculum has been revised continuously to reflect changes in the forestry profession, and now culminates with a senior capstone course that facilitates integration of skills and knowledge gained by undergraduates through the curriculum. A field practicum or camp experience has been a part of the curriculum in the forestry program at Michigan Tech since 1945. The field experience has taken many different forms with different locations, courses and content covered, level of instruction, and emphasis shifting from primarily timber-oriented instruction to a more balanced ecologically-based instruction. Many forestry programs across the nation no longer contain field practicums, and many of them are short overview courses (Table 1). Michigan Tech has one of the longest practicums of any SAF-accredited (Society of American Foresters) professional forestry degree program. The remainder of this paper will discuss the current structure of the Integrated Field Practicum, tools that we have implemented to aid in curriculum design and teaching course content, assessment techniques, and challenges that we face in teaching our program.

Table 1. Information regarding field practicums readily available on campus web pages of SAF-accredited professional forestry degree programs. The list may not be all-inclusive.

SAF-accredited professional forestry degree programs*	48
Schools with field practicums	28
Range of credits	2 to 19
Season	
Summer	18
Fall	3
Spring	4
Unable to tell	3
Length of practicum	2 to 15 weeks
Practicums longer than 4 weeks	10
Schools with semester-long practicums	4

*Number of accredited schools found on the SAF website as of March 12, 2004 (http://www.safnet.org/education/pforschools.cfm)

INTEGRATED FIELD PRACTICUM (IFP) AT MICHIGAN TECH

Structure of IFP

In fall 2000, a new Fall Camp was implemented into the curriculum coinciding with a quarter-to-semester university-wide transition. The previous Fall Camp was 10 weeks long, and consisted primarily of dendrology, basic forest biology, land measurements, and multi-resource inventory techniques. The new Fall Camp followed the semester schedule which increased to 15 weeks of instruction, and was moved from the sophomore to the junior year for forestry majors only. The suite of courses changed significantly to include advanced multi-resource assessment courses as well as forest management (silviculture and timber harvesting), forest health, and wildlife habitat. In 2003, the AEES majors were incorporated into the practicum. Approximately two-thirds of the course content is the same between majors, with development of three new courses for the AEES track (Table 2). Each track is composed of 16 credits, and consists of a blend of lecture, recitation, and lab or field time. When compiled, the average structured contact hours between students and instructors is 30-33 hours per week. The courses are now designed using a semi-block schedule that starts two weeks before the commencement of the on-campus semester schedule to optimize field conditions. Each class typically meets for one to three full consecutive days at different intervals throughout the semester to maintain continuity within each course, but allowing for integration of material between courses. The schedule contains instructional days, fieldtrips, and project days.

Table 2. Courses taught for the two tracks of Integrated Field Practicum at Michigan Tech.

Forestry		Applied Ecology and Environmental Science	
Practice of Silviculture	4	Survey of Silviculture	1
Timber Harvesting	2	Land Measurements & GPS	1
Land Measurements & GPS	1	Geomorphology & Vegetation	2
Multi-resource Assessment	3	Multi-resource Assessment	3
Wildlife Habitat	3	Wildlife Habitat & Population Ecology	4
Forest Health	3	Insect Ecology	2
		Forest Health	3
Total Credits	**16**	Total Credits	**16**

Field camp setting

The field practicum has been taught at the Michigan Tech School of Forest Resources and Environmental Science School Forest (Ford Forestry Center, FFC) centered around the village of Alberta, MI since 1985. The Ford Motor Company donated the town and 1800 acres of land to the School in 1954. The Michigan Department of Conservation followed with a gift of 1900 acres in 1957. The town was built in 1936 as a model sawmill community intended to represent a sustainable village during the depression. The FFC now has a dormitory, a dining facility, and several recreational buildings to accommodate student residents. The facility contains several buildings that are utilized by the IFP instructors, including a conference room/classroom used for lecture, a sample processing laboratory, a computer facility, and an additional classroom building. The FFC contains approximately 3700 acres in a variety of forest types, with several hundred more acres of nearby outlying tracts available for instructional use. The School Forest is located about 42 miles from the MTU campus, and eight miles from the nearest town.

Instructors and student body

The instructors of IFP are made up of three tenure-track faculty members, one research assistant professor, two instructors, and two resident graduate teaching assistants. The student body is composed of two undergraduate majors, forestry and AEES, graduate students just entering into the Peace Corps Master's International Program, and other graduate students seeking a knowledge and skill-base in forestry practices. The undergraduates have a background in basic forest measurements, woody plant identification, forest ecology, and basic statistics. The Peace Corps graduate students typically do not have a forestry or biological sciences background, making the practicum additionally challenging for them. We provide a week-long preparatory course in basic forestry (measurements, tree identification, and basic statistics) immediately before the beginning of the semester to help prepare these students for the beginning of the practicum.

Integrated curriculum design

After the first year of implementation of the new semester-long field practicum in 2001, it was apparent that instructors were not sure what content and skills were being taught in accompanying classes, nor how to integrate content between classes. The outcomes-based education model presented by Zundel and Needham (2000) served as a basis for identifying content and outcomes desired in the practicum. This model represents an alternative approach to the traditional teacher-oriented education experience, and facilitates the design of learning experiences (Spence 2001). Each instructor independently constructed lists for each class: concepts and knowledge taught, skills taught, problem solving and synthesis skills, and methods of assessment. Concepts and knowledge taught were specific to each course, and tended to follow closely the list of topics found on each syllabus. There was overlap in the skills identified by each instructor, with emphasis on technical and field skills (Table 3). Problem-solving and

synthesis skills encompassed written and oral communication, analytical skills, integration and application of concepts, critical review of published research and ideas, and the ability to predict the impact of forest management on vegetation, wildlife, and forest health. Methods of assessment were varied, and included the traditional means (graded exams, tests, quizzes, and assignments) as well as integrated field and lab exercises, field notes, class participation, and professionalism. The process of identifying knowledge and skills as outcomes aided in realizing commonalities in our courses, and facilitated better integration of concepts and integrated projects between courses. The technical, critical thinking and problem solving skills, and professional and interactive skills represent attributes currently desired by natural resource employers (Zundel and Needham 1996, Thompson et al. 2003).

The next step in improving the integration of courses in the IFP curriculum involved constructing a concept map of each course (Novak 2002). Each instructor identified three main axioms for their course that answer the question, "What three main points or concepts are most important for students to walk away with from your class?" Through the use of connecting lines and words, other concepts were connected and arranged around the three main axioms to concisely represent the structure of each course. After completion of individual concept
maps for each course, the instructors brought together their three main concepts, and discussed how to fit them together into a holistic concept map that represents the field practicum. This led to a simplified model of the concepts, courses, and driving forces that impact each discipline (Figure 1). This is a working model that is now presented to the students on the first day of the practicum as an introduction to the program. The individual course concept maps are also used to introduce individual courses, can be referred to throughout the semester so students can see how topics are inter-related, and are used to check progress in achieving the goals of the course.

Table 3. Some of the skills taught and assessment methods identified by the instructors for each IFP course.

Technical skills*	Problem-solving and synthesis skills	Assessment methods
Computer spreadsheets	Collecting, organizing, and analyzing data, and drawing conclusions	Exams, tests, quizzes
Report writing following the scientific method	Formal report writing	Memos
Basic statistics	Design silvicultural prescriptions, including identification of landowner objectives	Field and lab exercises
Orienteering skills	Integration of skills for use in other classes (e.g. GPS & GIS to map roads and streams)	Reports
Measurement skills	Applying concepts/knowledge to a particular parcel of land	Field notes
Vegetation sampling techniques	Understand relationships between concepts	Final project
Insect and disease sampling techniques	Preparing and presenting a formal oral presentation	Written report
Mammal track identification and documentation	How to work in groups to solve problems and accomplish large tasks	Oral presentation
Small mammal and carnivore monitoring techniques	Read and evaluate journal articles	Pre/post tests
Habitat models	Ability to predict impacts of forest management on I&D, wildlife habitat, etc.	Think-pair-share
Identification of appropriate timber harvesting equipment		Consensograms
Road and skid trail layout		Minute papers (end of class, muddiest point, main point)
Design and implementation of marking guides		Mid-semester assessment: what's working, what's not, suggestions for change
Use of tools (DMDs, guides)		In-class discussion exercises
		Participation
		Professionalism

*Not a comprehensive list of technical skills.

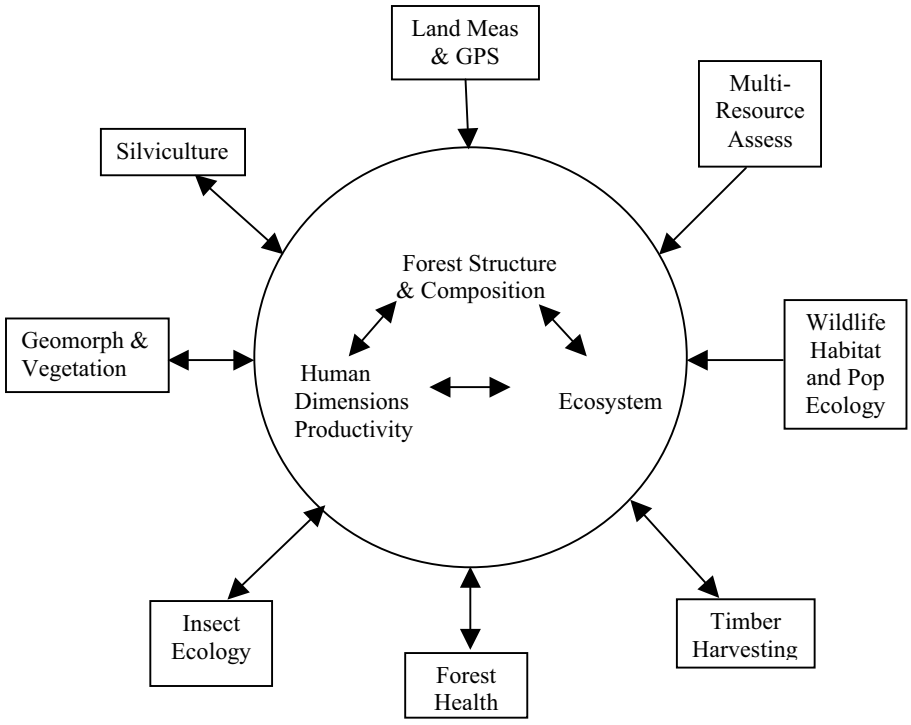

Figure 1. A simplified model of the concepts, courses taught, and driving forces that impact each discipline covered at IFP.

Teaching strategies and assessment

Each IFP course is taught with a combination of lecture, recitation, and lab or field-time. The structured instruction time typically involves lecture, discussion, and group activities, and is conducted in the classroom, laboratory setting, or in the field. Fieldtrips designed to expose students to different forest types, management objectives, management practices, and rules and regulations are organized with several public agencies and one industrial land owner. Active, inquiry-based teaching approaches are used by most of the instructors. Some techniques are based on an NSF-funded program called FIRST II (Faculty Institutes for Reforming Science Teaching, Lundmark 2002) that two of the instructors are participating in. Some non-traditional assessment techniques are utilized (Table 3) that allow continuous evaluation of student learning and progress. Many techniques are used to enhance student learning through active participation (think-pair-share, discussions, group activities), while other techniques facilitate quick assessment (minute papers, consensograms) and may or may not be graded. However, most instructors continue to use traditional assessment techniques (assignments, exams, etc.) to assign grades at the end of the semester.

Final Project

The semester-long field practicum culminates with a final project that utilizes skills learned, integrates knowledge across disciplines, and requires creative problem-solving. Groups of 4 to 6 students are assigned to an 80-acre parcel on the School Forest, and are given five days to conduct and summarize a complete inventory addressing vegetation, wildlife, forest health, and physical site characteristics (roads, streams, crossings, soils, and geology, Table 4). The second part of the project involves development of a management plan with comprehensive silvicultural prescriptions, a timber harvest plan, and an assessment of the impacts management will have on wildlife and forest health (Table 4). On the final day of the practicum, students present their projects to the faculty, staff, and student body within the School. To aid in assessment of individual participation, students fill out a peer-to-peer evaluations where they grade themselves and each other, identify the parts of the project they contributed most, and where they could have or expected their peers to participate more fully.

Table 4. Components of the IFP final project.

Part I: Assessment	Part II: Management Recommendations
Cover page	Silvicultural Prescription
Executive Summary	Current conditions
Table of Contents	Stand objectives
Introduction	Vegetation management
Vegetation Section	Special considerations
Wildlife Section	Wildlife: evaluate current habitat and
Forest Health Section	prescribed management for wildlife
Timber Harvesting Section	species
Silviculture Section	Forest health: evaluate the effect of
Summary	management
Maps	Timber Harvesting
Appendix containing field sheets, and	Marking
tables and figures not included in the	Harvest system
main report	Timber sale contract
	Maps

Challenges

A two-part feedback and evaluation system is used to assess the field practicum. The first tool is the standard university bubble-sheet evaluations that are issued for each class. The second tool is a questionnaire that is given to the students at the end of the term asking them to evaluate the facilities, living arrangements, dining facility, the schedule, workload, integration of material, and evaluation of the teaching assistants. The questionnaire also encourages the students to identify what they have learned, what the strengths of the program are, and asks for suggestions for improvement. An additional list of questions pertaining to each course is also given, allowing for assessment of teaching style, format of each class, content of the course, and identification of strengths and areas for improvement. The instructors are also asked to fill out an evaluation to identify the things that worked for them throughout the term, and areas that they would like to see improved or changed. The IFP coordinator then compiles all evaluations and provides a summary to the instructors for discussion.

The students consistently value the skills that they have learned throughout the practicum. Students are generally able to recognize the importance of working in groups, and comment that even though it is very challenging at times, they have acquired new skills for effective teamwork. The heavy workload has previously been identified as a concern, along with overlapping assignments for different classes. Low student morale related to the length and intensity of the program, especially among a small sector of the undergraduates, has interfered with the learning environment for other students. This tends to become a problem around week eight of the practicum. Efforts to actively maintain high student morale by instructors and staff at the facility have aided in maintaining a positive experience for all students. An additional challenge is truly integrating the forestry and AEES majors both inside and outside the classroom and field.

Some of the other challenges that come with teaching this field practicum include accommodating students with differing backgrounds and levels of experience (incoming Peace Corps students who typically do not have a science background versus the forestry and applied ecology majors), managing group dynamics for field and laboratory exercises, scheduling logistics, integration of material across courses, instructor dynamics, and assessment of an integrated practicum where grades are assigned to individual courses. The student body is different every year, reflecting different preferences for teaching style and organization. Built-in fluidity in the schedule and adaptive teaching strategies help accommodate these issues within a given semester.

SUMMARY

The integrated field practicum at Michigan Tech is a unique field experience. It is the longest field practicum of any SAF-accredited forestry program, and is taught at an advanced level, facilitating a challenging field experience for students. This field experience is steeped in tradition, and is a cornerstone of the curriculum for both forestry and applied ecology majors. The program itself remains fluid in the content taught,

approaches to teaching, and overall curriculum and structure of the program. The field practicum now represents a balance of timber-oriented knowledge and skills with ecological principles and approaches to management. This facilitates integration of traditional forestry majors with applied ecologists. Shifts toward outcomes-based curriculum design and active learning-based teaching models have improved student learning, and challenge both students and instructors. These different pedagogies have resulted in a more integrated, better organized practicum. Our approach follows the practice cycle suggested by Druger (2002): start by setting a goal, practice teaching, obtain feedback, reflect on the experience, make adjustments, and then practice some more. The experience for students and instructors in our program is very positive, and continues to improve with each semester.

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Concurrent Oral Presentations/Workshop
Administrative/Leadership Aspects of Teaching and Learning

Tuesday – March 16

Moderator: Terry Sharik

Centers of Excellence or Academic Enigmas? A Discussion of the Pros and Cons of Establishing Applied Social Science Departments in Natural Resource Colleges
Steve Hollenhorst, Wayne Freimund and Terry Sharik

The Role and Responsibilities of Partnerships in Building and Reinvigorating Natural Resource Organizations
Thomas G. Coon, William W. Taylor, Chris Goddard, Becky Humphries, Scott R. Winterstein, Pat Stewart, Kelly Millenbah, Laury Parramore, and John Robertson

Centers of Excellence or Academic Enigmas? A Discussion of the Pros and Cons of Establishing Applied Social Science Departments in Natural Resource Colleges

Steve Hollenhorst[1], Wayne Freimund[2] and Terry Sharik[3]

Variously called Departments of Environment and Society, Environmental Social Science, Society and Conservation, and Conservation Social Sciences, several Natural Resource Colleges around the country have recently created departments focusing on the social sciences. Several more are in the process of creating such units. The goal of these departments is to promote scholarship and creativity, educational curricula, and outreach programs relating to the social dimensions of conservation and environmental protection. Ultimately it is hoped such departments will advance our understanding and management of complex ecological social systems and enhance human-environment interactions.

But what is lost when we sequester the social science faculty in these colleges in social science units? Are they really empowered as is hoped or are they in actuality marginalized? While gaining collegiality and solidarity with our social science colleagues, have we also created unhealthy separations from our colleagues in the bio-physical sciences at a time when inter- and trans-disciplinary research and collaboration are needed?

In this session, short presentations will be made by three department chairs in various stages of creating and administering such departments. The rest of the time will be devoted to an open discussion of the issue.

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The Role and Responsibilities of Partnerships in Building and Reinvigorating Natural Resource Organizations

Thomas G. Coon[1], William W. Taylor[2], Chris Goddard,[3] Becky Humphries[4], Scott R. Winterstein[5], Pat Stewart[6], Kelly Millenbah[7], Laury Parramore[8] and John Robertson[9]

The future of fisheries and wildlife programs depends on meaningful and productive interactions between and among many disciplines and organizations. As these programs are truly trans-disciplinary, a key role of the unit administrator is to foster and nurture the development of the unit as an organization, particularly in its relationships with external constituents. This paper discusses the processes, challenges and opportunities of partnerships in relationship-building, and the changes in responsibilities that this type of venture places on all parties and their unit administrators. These challenges apply equally to the teaching, research, outreach and service missions of the academic unit. Over the past decade we have developed a unique and highly effective partnership with our state, federal and international partners, incorporating the teaching/learning process within the management and academic units and their related outreach missions. This partnership, the Partnership for Ecosystem Research and Management (PERM), has helped to better connect our programs to the needs of students, other campus units and external management/research/policy organizations in a highly interactive and meaningful relationship. Participating in this partnership to carry out the units' core missions has forged an inter-dependent network in which each partner relies on the others for a variety of support functions, including funding, personnel, focus and direction. As the connectivity and strength of the relationship grows, changes in any one compartment inherently impact the other compartments in the network. Thus for partnerships to remain healthy and vibrant, unit administrators must rely on trust, frequent communication and a willingness to collaborate in good times as well as bad.

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Concurrent Oral Presentations/Workshop
Communication

Tuesday – March 16

Moderator: Marty Lee

Adaptive Approach to Providing Translation and Transfer of Technical, Ecological Restoration Information to Land Managers
Doc Smith, Charlie Denton, John Bedell and Chuck Bullington

Oral Communication Across the Curriculum
Neville Peasley, Ted Needham and David Daugharty

Communication Strategies for Fire Management: A Video-Based Program for Creating Effective Citizen-Agency Partnerships
Ryan Gordon and Bruce Shindler

Digital Video in the Classroom: Communication Skills for Future Natural Resource Professionals
Bruce A. Shindler and Jeffry C. Hino

Adaptive Approach to Providing Translation and Transfer of Technical, Ecological Restoration Information to Land Managers

Doc Smith[1], Charlie Denton[2], John Bedell[3] and Chuck Bullington[4]

Recent Congressional action to pass a Healthy Forest Initiative indicates that a policy framework will soon be in place to support aggressive application of fuel reduction treatments at the landscape scale. Land managers (and the concerned public) can be overwhelmed with the question of how these landscape scale treatments should be designed, implemented, and monitored The Ecological Restoration Institute has provided two training workshops for land managers to support the design and application of science-based restoration treatments that solve the underlying problem of forest health. We learned that in order to develop the necessary culture in the workplace for public land managers to develop restoration treatments, we needed to transfer similar information to their supervisors. With feedback from several forest supervisors, we are prepared to move ahead with translation and transfer of information on a scale that must keep pace with the mandated aggressive approach for restoration-based hazardous fuel reduction treatments. We have summarized our efforts here to design effective workshops and the feedback that guided our adaptive approach to developing training.

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Oral Communication Across the Curriculum

Neville Peasley[1], Ted Needham[2] and David Daugharty[3]

The Forest Engineering Program at the University of New Brunswick recently identified excellent formal oral communication as a requirement for student graduation. However it recognized that there was no formal instruction being implemented to promote learning and ensure student success. In the past, students learned effective oral communication skills through osmosis, unstructured observation of others and a few organized opportunities to make in class presentations. Feedback on their performance was given summatively and little or no formative feedback was ever provided.

Effective oral communication has been recognized as an important ability for Foresters and Forest Engineers since 1996 (Abilities Required by Professional Foresters in Practise, 1996). However until the fall of 2003 there had not been a program or process in place across the curriculum to educate students about the components of effective formal oral communication. A small group of interested faculty aspired to define the abilities of effective oral communication and develop a program that could be implemented across the curriculum. The team searched for information from various sources and locations. As a result of this search a program and teaching resources were developed. The product was the development of a three part approach to teaching effective oral communication that would be implemented across the first, third and fifth years of the program. The approach consists of students repeatedly doing oral presentations (and conducting self assessments), studying the components of effective oral communication, and learning by assessing presentations by their peers. Formative feedback is received following each step of the process and students conduct self-assessments of their own presentations. It's believed that by using this modified Kolb's Learning Cycle approach, students will develop the necessary understanding and have the necessary practice to be excellent oral communicators by time they graduate. My presentation will briefly introduce the three aspects of our triad approach. I will focus on presenting the abilities that were developed and the structure of the abilities and present the obstacles we have faced during the first phase of implementation. A brief description of the detailed abilities description package may also be presented.

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Communication Strategies for Fire Management: A Video-based Program for Creating Effective Citizen-Agency Partnerships

Ryan Gordon[1] and Bruce Shindler[2]

Communication Strategies for Fire Management: Creating Effective Citizen-Agency Partnerships is a video-based program we are producing to provide resource professionals with specific tools for working collaboratively with the public on fire and fuel management. The production utilizes real world examples from successful federal agency (USDA Forest Service, BLM, and National Park Service) outreach programs to showcase effective communication activities from forest communities. The purpose is twofold: 1) To examine essential attributes of good communication in developing citizen-agency partnerships, and 2) To use innovative examples from local management units to help demonstrate these attributes in action.

Culture, in the anthropological sense, refers to the shared beliefs and practices of a community. If we accept the presence of an agency culture that exists independently from the community at large, then the video program's design must consider culture on two basic levels. First, delivery of the production's key points should be appropriately adapted for an audience immersed in an institutional (agency) culture. Second, the program needs to provide specific tools that enable land managers to bridge the gap that often exists between the agency and community at large. In an effort to effectively address these constraints, footage of existing, on-the-ground activities that exemplify creative communication strategies and approaches to forging durable, citizen-agency partnerships provide the primary source of information content for the video program. This footage is set against interviews with key players—both agency personnel and citizens—that discuss issues, ideas, and concepts related to the innovative communication strategies showcased in the video program. A field guide will also accompany the video to provide a summary of key learning points and a set of guiding principles for practical application.

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Digital Video in the Classroom: Communication Skills for Future Natural Resource Professionals

Bruce A. Shindler[1] and Jeffry C. Hino[2]

The Natural Resource Communications course in Oregon State University's College of Forestry is designed to provide students with the skills to be effective members of a resource organization and techniques for working in the public arena. The course focuses on teamwork and group dynamics, meeting management skills, public relations, interpretation, and public education and outreach. The course has been incorporating student digital video production as a capstone experience synthesizing these skills into a tangible product. After receiving a brief introduction to digital video production–from camera operation to non-linear video editing–each two-person student team produces a short (4-5 minute) video on a natural resource topic of their choice.

The video project provides students with an abundance of new skills; chief among these is an increased understanding of how to be an effective communicator and an improved confidence in their ability to work with others in the resource professions. Initially, students must identify the audience for their production and articulate how they intend to convey their proposed message. The process of preparing a written design plan, collecting necessary information (video footage), distilling the information into a succinct message (editing the footage) that includes a suitable narrative, and standing up in front of their peers to deliver the product is the take-home treasure for students in the course. In 2003, the International Association for Communication Excellence gave this course their highest award for instructional design.

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Concurrent Oral Presentations/Workshop
Graduate Education

Tuesday – March 16

Moderator: Paul Beier

An Integrative Model of Graduate Education in Biodiversity Conservation and Sustainable Production in Fragmented Landscapes
Jo Ellen Force, Lisette Waits, Nilsa Bosque-Perez, Sanford Eigenbrode, Steven Brunsfeld, Paul McDaniel, J. D. Wulfhorst, Jan Boll, Bryan Finegan, Celia Harvey and Eduardo Somarriba

Preparing Tomorrow's Natural Resource Educators
Edward C. Jensen and Michael S. Ahr

Teaching Natural Resources Students About Responsible Conduct of Research: How Are We Doing?
Mark W. Brunson and True Rubal

An Integrative Model of Graduate Education in Biodiversity Conservation and Sustainable Production in Fragmented Landscapes

Jo Ellen Force [1], Lisette Waits[2], Nilsa Bosque-Perez[3], Sanford Eigenbrode[4,] Steven Brunsfeld[5], Paul McDaniel[6], J. D. Wulfhorst[7], Jan Boll[8], Bryan Finegan[9], Celia Harvey[10] and Eduardo Somarriba[11]

To achieve biodiversity conservation and sustainable production in anthropogenically fragmented landscapes, scientists need to be trained in a holistic fashion that emphasizes integration and interdisciplinary collaboration. Traditional graduate programs in natural resources, conservation biology and agricultural sciences usually fall short of this goal as they train scientists with research knowledge and skills in narrowly defined disciplines. Rarely, if ever, is integration across disciplines facilitated, valued, or emphasized in either coursework or research activities. We present a NSF Integrative Graduate Education Research Training (IGERT) funded experiment in graduate education that designs and evaluates an integrative educational model with an emphasis on developing interdisciplinary research knowledge and skills in the biological/ecological, physical and social sciences. This educational program involves faculty and students from seven departments and two colleges at the University of Idaho and several research areas at the Tropical Agricultural Research and Higher Education Center (CATIE) in Turrialba, Costa Rica. Nineteen doctoral students have been recruited and are working in five interdisciplinary teams to address research questions in biodiversity conservation and sustainable production in temperate and tropical ecosystems in Idaho and Costa Rica. Team members represent conservation genetics, forest ecology, agroecology, entomology, soil science, water quality, aquatic ecology, GIS, sociology and economics. As we approach the halfway mark of this five-year project, recruitment of doctoral fellows, the structure of the academic program and the interdisciplinary teams, the challenges we've faced and the successes of this new graduate program will be highlighted.

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Preparing Tomorrow's Natural Resource Educators

Edward C. Jensen[1] and Michael S. Ahr [2]

Whenever natural resource professionals discuss the future, issues arise to which "education" is the answer. Resource managers and policy makers need to understand more about new scientific discoveries; the public needs to understand more about management principles; teachers need to understand more fundamental natural resource science; youth need to understand more about where raw materials come from. It seems that someone always needs to know more about something to make better decisions.

But who will conduct this education? Natural resource professionals often head willingly into the fray, but their time is limited, as is their understanding of appropriate education methods. Teachers and public affairs specialists typically have good education and communication skills, but often lack a detailed understanding of natural resource science and management techniques.

For the past decade, Oregon State University has offered an MS degree in "Natural Resources Education and Extension" to help prepare students who want to bridge this gap between those who know and those who need to know. Coursework is split between natural resources and education/communication. Typical theses and projects require students to identify an audience with an educational need and to design an educational program to meet that need.

In this presentation, we'll discuss how this program works, give examples of typical projects, and discuss job opportunities. We'll also solicit feedback from members of the audience who offer similar programs and ask how this idea translates into a PhD program.

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Teaching Natural Resources Students About Responsible Conduct of Research: How are We Doing?

Mark W. Brunson[1] and True Rubal[2]

Universities increasingly are scrutinized for compliance with principles of responsible conduct of research (RCR). In natural resource management, RCR principles come into play in two aspects of research and education: wildlife projects involving live vertebrate animals, and economic and social science projects that use data from human subjects. Under the Animal Welfare Act research proposals involving trapping and/or handling of live wild vertebrates must be approved by an Institutional Animal Care and Use Committee (IACUC). Federal regulations require review of all research involving human subjects, including on-site interviews and attitude surveys, by an Institutional Review Board (IRB). However, because the rules are often assumed to apply mainly to review biomedical studies that put humans or laboratory animals at potential risk, natural resource students and even researchers may know little about them.

This paper describes results of a survey of U.S. natural resources programs about teaching of RCR principles. Is the teaching focus mainly on general ethical principles, or are there specific units on IACUC and IRBs? Are topics taught to both undergraduates and graduate students, or only to graduate students pursuing thesis research? How often, and in what courses, are RCR principles taught? What is the relative frequency of education about animal welfare vs. human subjects in research? Do students engaged in research as part of classroom instruction have to go through some sort of IRB or IACUC review as they would if the research were intended for an eventual thesis and/or peer-reviewed publication?

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Teaching Urban Forestry Online

Jim Hubbell [1] and Fred Baker[2]

Because of changing faculty commitments, urban forestry had not been taught in almost 10 years, despite an increasing need, especially by professionals already working away from campus. Moving the course online was perceived as an effective way to meet this need while minimizing faculty and/or student travel.

The course is designed to work within the WebCT environment, and discusses 20 major topics (modules) during the 15-week semester. Each module consists of a subject matter presentation including both text and figures written in HTML. Students must submit at least one activity each week, which requires the students to use newly gained information or to search the Internet and other resources for additional information. These activities provide a common foundation for learning, but the real learning in the course occurs in weekly discussions, to take advantage of the diversity of expertise within the group. Faculty and guest speakers pose questions to start the discussion; the instructor and teaching assistant facilitate those discussions. The course was first offered in the spring semester, 2002 and each semester since.

Although technical issues can hamper student progress, adult learners frequently go far beyond the minimum requirements as they become engaged in the material. Learning through the discussion format works best when the students are all on the same topic during the same timeframe.

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The FERM: Forest and Environmental Resource Management

James M. Schmierer, Jr.[1], Glenn D. Mroz[2] and Scott D. Noble[3]

ABSTRACT: In order to foster greater technical competency and to improve confidence in the field, undergraduate students are offered a course known as the FERM, Forest and Environmental Resource Management. Teams of students from forestry and applied ecology degree programs work with faculty, staff, and an advisory board to implement sustainable resource management plans developed by students on the School Forest lands. The FERM program is designed to provide a variety of hands-on experiences in realistic field and management settings that incorporates research and conservation objectives. Specific activities include timber sale preparation and administration, wildlife and ecological surveys, road layout, tree planting, regeneration surveys, study plot layout and establishment, and permanent plot remeasurements. Assessment in the FERM emphasizes student outcomes achieved using group and individual instruction, guided inquiry, technical training, site visits, applied field exercises, and professional interaction. This promising program provides high-quality learning experiences for students but also presents significant challenges.

INTRODUCTION

Societal demands on forestry professionals are greater than ever before. Properly training future forest practitioners requires the development of many specific skills and abilities as a part of the total educational experience. A level of comfort in the woods, an understanding of multiple resource values, application of basic operational forestry procedures, positive interaction with the public, co-workers, and allied professionals, sound problem-solving and decision-making skills, and good oral and written communication skills have been identified as abilities required of practicing forestry professionals (Brown and Lassoie 1998; Zundel and Needham 1996). The traditional approach to forestry and natural resources education may not provide the type of learning experiences that foster skills development. The emphasis of the traditional approach is on curriculum development, and centers on specific courses required and the sequence in which they are taught (Brown and Lassoie 1998; Jensen and Doescher 1998). A more effective approach to university education is to design specific learning experiences (Spence 2001).

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Utilizing outcomes-based techniques in college degree programs is a way to foster development of the crucial skills and abilities that future natural resource professionals will rely on to be effective throughout their careers. Outcomes-based educational approaches are based on a student's ability to demonstrate what they have learned by exhibiting a certain level of proficiency with a particular set of skills in a realistic environment. Effectiveness of instruction and student assessment rely on how well the given outcomes have been achieved (Zundel and Needham 2000). A unique outcomes-based approach to learning known as the FERM has been developed in order to provide quality learning experiences for forestry and applied ecology students in a realistic setting.

THE FERM PROGRAM

The School of Forest Resources and Environmental Science at Michigan Technological University has instituted a new program known as the FERM: Forest and Environmental Resource Management. The FERM represents an opportunity for professional development of foresters and ecologists in which practical experience and skills are attained in an intimate team environment with appropriate guidance from School faculty and staff. Each FERM team is self-initiated, and unlike typical courses, FERM endeavors are not only academic, but also real, on-the-ground implementations of forest and environmental resource management on portions of the 5,600 acre Research Forest. The decisions made and the work accomplished by students directly impact the resources, the environment, the School, and society. In addition to traditional activities accomplished by resource managers, the FERM experience provides challenges that are unique among most undergraduate education programs. One of the greatest benefits of this program is the students' ability to to see and evaluate the ecological and economic effects of their own land management strategies on the ground during the completion of their college education.

FERM STRUCTURE

Enrollment in the FERM is open to both forestry and applied ecology majors who have completed basic coursework in forest measurements and dendrology. Each FERM class becomes a management team that works to implement management plans developed for School lands during the year-long senior capstone sequence which have been reviewed and/or revised by the Research Forest and Ford Center Management Committee, which functions as the board of directors (Figure 1). Semester objectives are laid out on a timeline and the FERM team works with resource professionals and faculty in the school to accomplish them. The FERM class is an elective that can be repeated by students during the completion of their undergraduate coursework, and is offered during fall, spring, and summer semesters.

FERM ACTIVITIES

Administrative activities include weekly meetings, long-range planning and scheduling, weekly and semester progress reviews and reporting, procedures and internal controls development, timber sale contract development, oversight of the sealed bid process, and equipment/supply inventory, maintenance, and purchasing. Field activities include timber and ecological assessments, wildlife surveys, regeneration surveys, GPS data collection, boundary and sale unit line establishment, permanent plot remeasurements, research plot establishment, measurements, and photographic documentation, timber marking, tree planting, timber sale supervision and administration, road/BMP assessments, post-sale assessments, and infrastructure maintenance and installation (trails, signs, gates, etc.). Technical training consists of GPS/GIS mobile data collection testing and updating, development and use of data analysis software and spreadsheet utilities, and web content development.

ASSESSMENT

Student assessment in the FERM program emphasizes student outcomes achieved with a combination of group and individual instruction, guided inquiry, technical training, site visits, applied field exercises, and professional interaction. At the end of each semester, the FERM team produces a final oral and written Implementation Report that is presented to the Research Forest and Ford Center Committee. These reports also provide consistency and a mechanism for long-term tracking from semester to semester as student membership in the FERM changes and activities on the ground are completed. Peer review and evaluation of team progress reports are also used to assess individual and team performance.

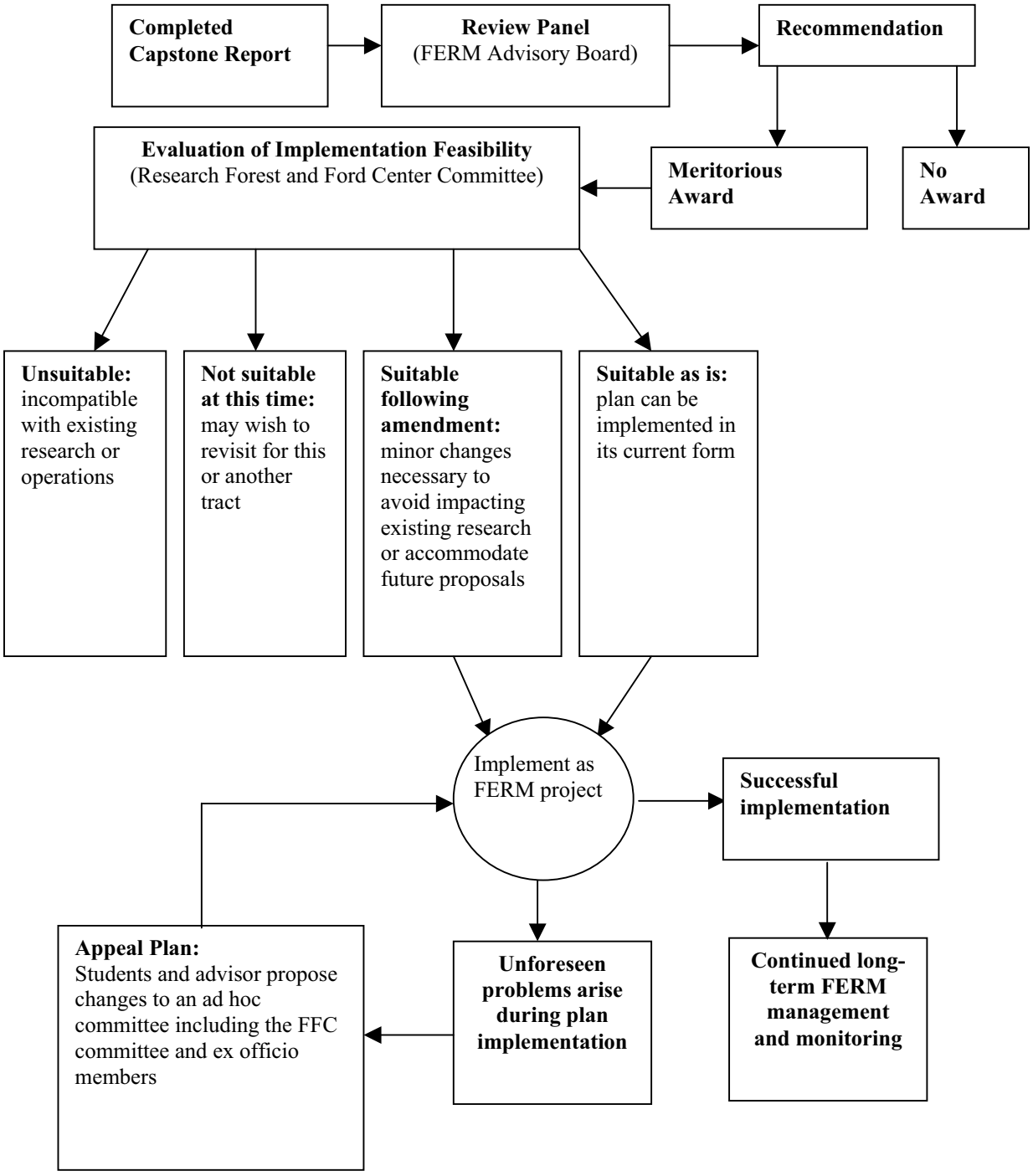

Figure 1. School of Forest Resources and Environmental Science-FERM Integration Model.

CONCLUSIONS

The FERM initiative represents a unique educational opportunity, but also presents significant challenges for instructors and student participants. The long-term nature of on-the-ground activities included in management and conservation plans requires that all work accomplished by each semester's team be carefully documented in the final Implementation Report. Scheduling around other classes and extreme weather presents yet another challenge. Still more difficulties are encountered if enrollment exceeds ten students in any one semester. However, the FERM approach holds great promise for improving natural resources education delivery by providing the most realistic learning experiences possible. FERM activities using the latest techniques and state-of-the-art tools also provide students with a direct link to conservation, sustainable management, and applied research on the Research Forest. Working independently and as a team, producing tangible results, and reporting to a board of directors all provide valuable real-world experience and a powerful learning environment. The FERM, collectively with other inquiry-based and outcomes-based courses in the School of Forest Resources and Environmental Science curriculum are crucial in developing competent, confident graduates who are well-equipped to move directly into the work force or graduate school.

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Preparing the Next Generation of Public Land Managers: A Collaborative Approach to Summer Internships

Ben Baldwin[1], Kathy Voth[2], Mark Brunson[3] and Ben Bobowski [4]

Tehabi (te-HA-be) is a word symbolizing the spirit of teamwork. The program operates from Utah State University's College of Natural Resources with partners in the Bureau of Land Management and the National Park Service. Its mission is to enhance natural resource management by facilitating an environment where natural resource professionals, scientists, students and communities can develop sustainable solutions by sharing experience, information and ideas. Through a unique process of training, focused internships and mentoring, Tehabi facilitates development of natural resource leaders with an appreciation for, and the skills to bring together science, policy, and diverse values.

Now in its sixth year, Tehabi includes elements not commonly found in other academic or seasonal employment programs. Students begin with a two-week field course where they learn about organizational culture, community context, and systems theory as well as valuable field skills. Summer-long internships with agencies and non-governmental organizations provide experience with the technical aspects of management as well as opportunities to transfer experience and techniques among students, host office staff, and local residents. The program's emphasis on mentoring, supported by written and oral assignments, helps interns develop coping strategies to "survive" and even "thrive" in an agency culture. The results include enhanced transfer of institutional memory and completion of on-the-ground projects. Tehabi's most important product is a group of future leaders with both technical and collaborative skills who have an understanding of the environment in which they will work and a network available to support them as they enter the work force.

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Recent Reorganization of the College of Natural Resources at Utah State University: Implications for Teaching and Learning

Terry L. Sharik[1]

On July 1, 2002, the College of Natural Resources at Utah State University reorganized into three new departments, i.e., Aquatic, Watershed, and Earth Resources; Environment and Society; and Forest, Range, and Wildlife Sciences. The first two departments focus on the bio-physical sciences, while the third emphasizes the social sciences in an interdisciplinary setting. This reorganization represented a deep mixing of faculty, staff, and students from four former departments, i.e., Fisheries and Wildlife, Forest Resources, Rangeland Resources, and Geography and Earth Resources. The main effects of the reorganization on graduate education were the enhancement of linkages with basic and applied academic programs from other sectors of the university, and an increase in the number of graduate degrees and certificates offered. The main influences at the undergraduate level were the loss of a common core to all departments, an increase in undergraduate degrees offered (and associated specialization), and the requirement for strong cooperation among departments in the college to satisfy professional accreditation of degree programs and certification of individuals.

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