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Linda Marie Nagel

*School of Forest Resources and Environmental Science, Michigan Technological University, Houghton*

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

Linda Marie Nagel<sup>1</sup>

**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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<sup>1</sup>School of Forest Resources and Environmental Science, Michigan Technological University, 1400 Townsend Drive, Houghton, MI 49931, (906) 487-2812, [lmnagel@mtu.edu](mailto:lmnagel@mtu.edu)

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
<b>Total Credits</b>	<b>16</b>	<b>Total Credits</b>	<b>16</b>

### 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.

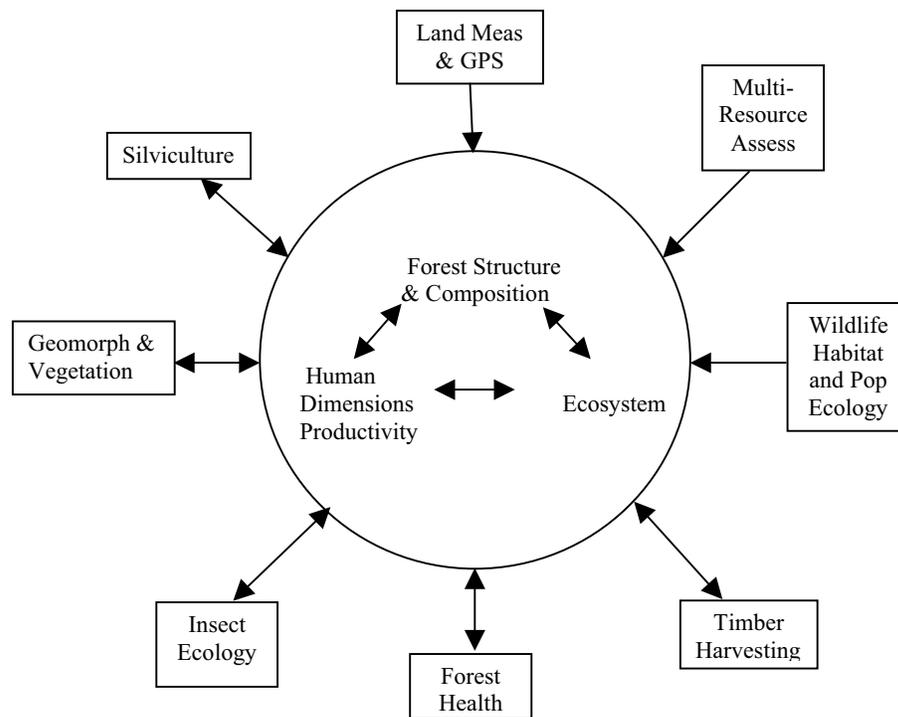


Figure 1. A simplified model of the concepts, courses taught, and driving forces that impact each discipline covered at IFP.

### 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 prescribed management for wildlife species
Forest Health Section	Forest health: evaluate the effect of management
Timber Harvesting Section	Timber Harvesting
Silviculture Section	Marking
Summary	Harvest system
Maps	Timber sale contract
Appendix containing field sheets, and tables and figures not included in the main report	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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