1-1-2002

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Recommended Citation

Canham, Hugh O. (2002) "Integrated resource management courses : Lessons learned after six years," *Natural Resources and Environmental Issues*: Vol. 9, Article 37.
Available at: http://digitalcommons.usu.edu/nrei/vol9/iss1/37

INTEGRATED RESOURCE MANAGEMENT COURSES: LESSONS LEARNED AFTER SIX YEARS

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ABSTRACT: Integrated management courses, or capstone courses, have been inserted into many forestry and natural resource college curricula. The general intent is to have the students bring together the knowledge they have gained in other courses and synthesize an holistic solution to some set of issues. At Syracuse such a course was made a required part of the senior year in the Forest Resources Management program starting in the fall of 1996. The author has taught the course almost every semester, sometimes in conjunction with others. Over the years various procedures were tried, different cases utilized, and different requirements placed on students. This is still a work in progress. However, many important lessons have been learned. These will be covered along with student reactions to different kinds of cases and procedures.

INTRODUCTION

At Syracuse, we instituted a major change in our undergraduate curriculum in the late 1990s. As part of that change we instituted a senior required course designed to integrate all subject matter. We refrained from calling it a "capstone" course, yet it is similar to most capstone courses. Since its inception in the fall of 1997, I have been the principal instructor in the course, save for one semester when I was on sabbatical in the fall of 1999. The course has been very interesting to teach. However, it has been a "work-in-progress." That is, I have learned many things for each semester and revised the course slightly to incorporate these things. Recently we have also

used this course to assess our overall Forest Resources Management program. In this paper I will briefly cover the course objectives and procedures, give the chronology of the cases used, and describe in detail the lessons learned. As a final note I will cover what we learned from a one-semester use of this as an assessment tool.

COURSE OBJECTIVES AND PROCEDURES

Objectives

Course objectives are divided into concepts and skills. The concepts that the course aims to instill in students are (1) to see the forest as a unified biophysical and socioeconomic system; (2) to develop forest treatments for maintaining or altering desired conditions at the stand, forest, and landscape level; (3) to recognize the role of social, legal, political, and economic factors and values that influence choices in forestry; (4) working with a client and providing service to a community. Skills that course aims to sharpen are (1) the ability to use various problem-analysis and decision-making techniques in resource planning; (2) working with other professionals in a team situation; (3) presenting technical material to a client in a form that can be understood by the client.

Procedures

The course uses a case approach. Students work in teams on preparing management guidelines, recommendations, or a management plan for the client. The course integrates students' knowledge gained in other courses and through other educational experiences. In addition, each particular case has its own special circumstances. As such, detailed procedures are developed by each team each semester. However, the following are done each semester:

1. Each team makes an initial visit to the property with the instructor. This trip is either on an afternoon or Saturday. College transportation is provided for this initial visit.

2. A written work plan for the case is developed by the team and presented to the class early in the semester. This work plan includes what will be achieved during the semester, how any data will be obtained, and a tentative timetable for completing the work.

3. Each team makes a brief presentation to the class on their case around mid-semester. This presentation includes a brief description of the case setting, owner's objectives, work to be accomplished, and progress to date. This oral presentation is accompanied by a written progress report.

4. Each team is encouraged to meet with the instructor or the graduate teaching assistant at least every other week. The assigned class time can be used for such meeting or other time by appointment.

5. Each person in the course is to attend at least one presentation by someone outside of the course. The purpose of this is to see how others present material and to learn from others' strengths and weaknesses. Students are to turn in a brief (one paragraph) on the presentation attended and lessons learned.

6. Each team makes a presentation of their work at the end of the semester to the client. This is preceded by a "dry-run" of the presentation made to the entire class.

7. A typed written report is prepared by each team. A draft is turned in during the last part of the course. This draft is critiqued by the instructor and returned for use in preparation of the final report. Details of each report are determined by each case. However each report should contain the following:

> Project objectives
> Case setting, property description
> Owner's objectives

> Methodology used to collect information and prepare plan
> Management alternatives considered (must have at least one realistic alternative in addition to the preferred, or final, one)
> Evaluation of alternatives
> Recommendations

8. This is a "service-learning" course. As such, it combines service to the greater community with student learning in a way that enhances the student academic experience while simultaneously improving the community. The service is integrated into this course's syllabus, and it facilitates the "hands-on" component of the material you will learn in the classroom. A final assignment of this course is for each team to prepare a synthesis paper that focuses on the team's contributions to the community, individual personal growth, and what the team learned in service relative to course content.

CHRONOLOGY OF CASES

The course was instituted as a full requirement in the Fall semester of 1997 and has been taught each semester (fall and spring) since then. Cases have been selected based partly on conditions known to the instructor and partly from requests from landowners and other stakeholders desiring management advice for properties. The following are the cases worked on and approximate enrollment each semester:

- Fall 1997: College forest, hypothetical division of 3,000 acres into 4 parcels; 60 students

- Spring 1998: McLean Game Preserve, Connecticut, 3,600 acres; 20 students

- Fall 1998: State Forest in New York, 6,000 acres; 60 students

- Spring 1999: Vegetation Plan for Syracuse City Zoo; 20 students

- Fall 1999: State Forest in New York, 6,000 acres; 30 students

- Spring 2000: Urban forestry plan for City of Syracuse; 20 students

- Fall 2000: Town of Webb forest in Adirondacks, 7,000 acres; 30 students

- Spring 2001: Two non-industrial forest properties (5 acres, 35 acres), Town park plan, recreation on State Forest in New York; 16 students

- Fall 2001: Sterling Nature Center and surrounding lands, 2,800 acres; 30 students

- Spring 2002: Oneida nation lands (700 acres), Cazenovia Link Trail (20 acres plus 1 mile); 11 students

LESSONS LEARNED

As stated in the introduction, this has been a "work-in-progress." Each semester brought new challenges and things learned from the previous semesters. These were incorporated into the syllabus for that semester.

Use a Real Case

The first semester the course was taught we used one of the college properties that students had already been on. The feeling was that this would make it easier for the students since they knew something about forest types,

soils, boundaries, and access. However, in order to simulate management objectives, we gave them four different hypothetical situations and had each team work on a different one: non-industrial private owner, forest industry, public agency, nongovernmental nonprofit organization. We learned that this took away much of the interest in the course. Subsequently, a real case with real owner objectives has always been used. Interest by the students has been much higher. Furthermore, the real case also introduces the student to the vagaries of owner objectives and trying to work with clients.

Owner Objectives

It is very helpful to have clients who have general multiple-use objectives and are not bound to any narrow pre-determined, single-purpose goal. For example, when working on the Sterling Nature Center, the managers stated that no timber harvests would occur. However, in order to maintain the other values, tree cutting is necessary (wildlife habitat, visual corridors, maintain early successional vegetation, etc.). The students had difficulty thinking about how to manage and had to be encouraged to develop management plans that did incorporate cutting. Their added job was to show the client how such cutting enhances the other values desired. On the other hand, whatever the objectives are of the owner/client, this is what the students must deal with. This is the reality part of the course.

Geography

At Syracuse, the course is taught along with many other courses that semester. As such it is virtually impossible to schedule the course for a full day. It must share the day with other lectures, labs, etc. However, at least one site visit is done for each team with the instructor accompanying them to introduce them to the property and to point out various management alternatives and any unique circumstances. Therefore, properties must be located within one hour's drive from campus. Students cannot be "required" to use their own transportation to visit the site, but they want to and desire to make site visits at different times, for example, Sunday morning. They will do so if the travel is under one hour. Another geographical consideration at Syracuse is the weather. This means that during the "Spring" semester (January 15 to end of April) one needs to avoid sites north of Syracuse on the Tug Hill Plateau, which are subject to extremely heavy snows. In addition, sites for the "Spring" semester need to have good, all-weather access. These are not constraints in the Fall semester.

Team Size and Composition

A variety of team sizes and methods of selecting team members has been tried. The best team size appears to be three people. Four and five will work if the team members are all outgoing and fully committed to the task. However, a smaller team is preferred if logistically possible. Students can be allowed to select their own team members, but this does not seem to be an optimal method. Random selection of student team members or purposeful selection of students to be on teams based on background, personality, skills, etc. is preferable. The former (random selection) is easy; the latter (purposeful selection) requires prior knowledge of students or having a good database from each student at the beginning of the semester.

Instructions to Class

Students come into the class with a general history of being told what to do, the form for final reports, what data to collect, how to report them, etc. In many courses forms or fill-in sheets are used in lab or homework exercises. In the Integrated Resources Management course we have resisted giving detailed instructions. As one student once put it, "You throw us into the deep end of the pool and tell us to swim out." This is indeed part of the learning experience. Students are expected to figure out what data they might need, how to obtain that data given the limited time and resources in the semester, what kinds of recommendations to develop, how to evaluate the alter-

natives, and how to present their findings. At first no further instructions were given. However, as time went on we found it useful to give students certain deadlines and to require certain items. At present I require the following items from students:

1. A written work plan from each team early in the semester setting forth how the tasks will be completed.
2. A journal or record of work done by each student due at mid-semester and at the end of the semester. Also included in this journal are impressions of how well the team is functioning, and if all members are contributing to the effort. The journals are not seen by anyone other than myself but are useful in assessing how well particular teams are functioning and spotting early personnel problems to take corrective action.
3. Certain items are specified in the final report, depending on the particular case. For example, an analysis of growth and yield for a particular stand is often required using a computer growth-and-yield model. Usually TWIGS as embodied in the NED/SIP computer package is used since this is what the students have used in an earlier forest measurements course.
4. A preliminary presentation, or "dry-run" of the final oral and visual presentations is always done. At these preliminary presentations the team is given a critique. This is done with all students present so that each can learn from others' problems.
5. New this year is the "service-learning" component. Each team will prepare a one- or two-page typed paper that reflects on how the case and work on it may have contributed to the growth, development, or enhancement of the local community. These reflective papers will be shared with the entire class.

Resource Information

Having data available is a problem. Students do not have the time to gather large amounts of data and still develop management alternatives, evaluate them, and prepare a final report within the scope of the semester, given the large scale of several cases. In addition, it is not realistic to have all information readily available. One valuable lesson the students learn is that in the "real world" one might not have all information desired! Any information that does exist for the particular case is noted or assembled for students' use. For example, when working on the state forest, a detailed type map and vegetation inventory were available. However, this was not true for other cases. Aerial photographs and U.S. Geologic Survey topographic maps have always been available and sometimes digitized imagery. Students have had an introduction to Geographic Information Systems and they are encouraged to use the technology, but not required to. For soils information the students are referred to the USDA soil surveys available in our college library. The guiding rule is if students feel they need information, they must find it or do without.

Separate Cases vs. One Case

Some semesters several small properties have been used as cases with each team working on a different property. This has usually produced the best results both in terms of student products and student interest. The more detailed student performance is also more satisfactory to the client. However, logistics tend to interfere with this. Given a large class it becomes extremely difficult for one instructor to take students to up to a dozen different sites early in the semester. Working with several teams on one large property has been satisfactory by dividing up the property into smaller areas. Students can then feel a sense of ownership for their area, and it is small enough for them to cover the area and get to know it. However, at the end, the client is given several sets of plans or recommendations, each for a different area. Clients either need to understand this or some combining of individual team reports into a unified property-wide plan is required by the instructor or by other students.

Working with a Client

There have not been any problems with the clients. Indeed, all have been satisfied with the students' work and thankful for some assistance. The client is told at the outset that these are students and that it is primarily a "learning experience." An initial meeting is held with the client and the students, usually on or near the client's property. Further contact between the students and the client during the semester is permitted, but students are counseled to get their questions specific and to not overburden the client with requests. Discussion between the students and the instructor usually precedes any contact with the client.

USING THE COURSE TO ASSESS THE PROGRAM

The Faculty of Forestry at Syracuse developed a comprehensive set of "Professional Concepts and Skills" that the faculty felt all students should possess by the time they graduate from the Forest Resources Management program at the B.S. level. For each concept or skill, a cognitive level can be achieved (based on Bloom's "Taxonomy of Cognitive Levels"). These levels are

1. Knowledge	Remember facts, terms, concepts, definitions
2. Comprehension	Explain, predict, interpret, infer, summarize, give examples
3. Application	Apply, solve problems, modify, demonstrate
4. Analysis	Break down material into component parts to see interrelationships
5. Synthesis	Produce something new or original from component parts
6. Evaluation	Make a judgment based on set of criteria, appraise, judge

based on consideration of how students performed in the Integrated Resources Management course. The median level achieved by the class was estimated along with estimated high and low. What follows below are the comments on how students performed on each of the "Professional Concepts and Skills."

Understanding Forests

Students generally had a good grasp of relationships among different biological forest elements and how to identify species. It is difficult to apply Bloom's "Taxonomy" to this concept area, especially as it applies to levels 3 and above. The students' use of soils information was variable. Some just mention the particular soil series, which suggests just a parroting of material found in a reference. Others use the soil information in management decisions.

Manipulating Forests

Students seem able to understand different ways of altering ecosystems. However, they do not appear very imaginative as far as developing new ways to manage the vegetation or applying techniques discussed in one context to another set of species. In the course different treatments were mentioned on field trips and in class discussion. In the student reports and presentations it is difficult know if the students really comprehend techniques such as mowing, disking, or controlled burning, or if they are just repeating what they heard.

Measuring Forests

Students appear good at identifying tree, lesser-vegetation, and animal species. They can apply known techniques in forest inventory but seem uncomfortable with a quick overview of one or two point samples to get some idea of stand conditions. Knowledge and use of computer growth-and-yield models is extremely variable. Some students seem at home with the computer side of the model but do not make the connection with applied

management. They do not see the models as being of use in decision making. Other students do not comprehend what the models can or are doing. They just go through the motions. Finally, a few students have the near-full comprehension of how to use a computer growth-and-yield model in forest management planning and decision making**.**

Managing Forests

This appears to be a weak area for some students. They are good as describing but not so good at evaluating and making choices. In their defense, for the class project this semester they were asked to give recommendations and not make a definite decision. However, many students were able to bring in different aspects of the management situation and address owner concerns and objectives. Ability to correctly apply and use quantitative investment analysis tools is extremely variable.

Policy Making

This was a difficult criterion to evaluate in the FOR 490 course. However, many students seemed to realize that some group would make final decisions and that some process would be involved. Many seemed to grasp the notion of the biological history of the forest, but it is unknown if the social history of land use and the changing policy-making climate over the years is understood.

Communicating

This skill area is very variable among students. All students do seem to recognize that they need more practice with public speaking. Written communication and oral presentations were quite variable for the rough drafts and dry-runs, among student teams. However, students responded well to the comments made on their drafts, and the final products were much improved.

Ethics and Leading

These two concept areas are grouped together for discussion. Students functioned well in teams. They put a conscious effort into completing the assignments, and material was usually turned in on time and in a professional manner. The required journals and evaluations of their team members showed thought and working together.

Problem Solving

Students can perform problem solving. The main area needing improvement is to get them to recognize that each part of their education must be integrated together in the final real-world problem solution. In addition, getting students to think innovatively rather than just applying blindly something they have had in a course is challenging.

Overall Conclusions Regarding Assessment

The students in the current senior class in the undergraduate Forest Resources Management program at SUNY-ESF perform at a passing level for graduating B.S. degree holders. However, more emphasis should be placed in our curriculum on critical analysis of one's use of terminology, writing and oral presentation skills, and getting students to really understand and be able to apply material they have been "exposed" to.

The various concepts and skills seem to be capable of application to assessment both at the course and program level. A recommendation would be that each instructor try to assign achievement numbers (cognitive level reached) for each course taught. At least it would seem very useful to do this for certain integrative types of courses.

SUMMARY

As a final footnote, a few comments from the student evaluations of the course seem in order:

- A few students commented that they would have liked a property that had more of a timber emphasis because that is what their curriculum has focused on for the last four years.
- The exercise of working together in a group was seen as generally a very good experience.
- Students often commented that they really did not learn anything new in this course but did get to apply previous knowledge.
- The use of a real case is seen as very good.
- Some students would have liked to been given more specific instructions as to exactly what was "required" in the way of a timber cruise, soil survey, etc.
- One student commented that we should involve students from the environmental biology program since, "they know more about preserving biodiversity and wildlife management than forestry students. Why not truly integrate all levels of natural resources management."