APPROPRIATE EDUCATIONAL STRATEGIES FOR TEACHING FOREST RESOURCES MANAGEMENT AND ECONOMICS: QUANTITATIVE OR QUALITATIVE?

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ABSTRACT

Those of us who teach the important concepts of forest resource economics and management to a largely disinterested student body and profession have long tried to develop teaching strategies to make the subject interesting, understandable, and useful. While I believe that there is general agreement among us about what should be taught in this area at the undergraduate level, there are significant differences in our approaches. In this paper I will discuss the advantages and disadvantages of quantitative and qualitative approaches and argue for an appropriate balance. I will begin with a review of a joint SAF-NSF forestry curriculum development effort of the early 70's that was aimed at both integrating forest economics and management and in developing a quantitative rational, analytical approach to forest management. There is evidence to suggest that:

1. We have gone too far in the direction of the symbolic or abstract in the design of undergraduate coursework in this area; and (partially as a result)
2. We have not made much progress in making the profession as a whole more objectives-centered and rational-analytic in its approaches to the solution of operational problems.

I will conclude with some recommendations based on my experience with a reasonably quantitative faculty about directions that might produce better results.
INTRODUCTION

Commonly held attitudes among forest resource professionals seem to suggest that resource management decisions are often best made on experiential (or intuitive) grounds rather than on the basis of considered rational analysis. In practice:

- management focus is often on means rather than on ends (managing to achieve a regulated condition instead of managing to optimize the stakeholder's objective, subject to appropriate constraints);
- management focus is often on biocentric goals (some presumed consideration of systems health or diversity) rather than on anthropocentric (economic) goals suited to the utilitarian interests of the stakeholder; and
- management is directed a single dominant goal or objective where a multiple objectives approach would be more appropriate to the interests of the stakeholders and their state of knowledge about production possibilities and associated tradeoffs.

The literature of the field is filled with attempts to justify the traditional approach. Writers from Kauffman to Baden to Alston to Duerr to Teegarden and others have analyzed the philosophy of the forestry profession in attempts to explain our seemingly collective view toward forest resources and their management. I won't summarize this work which is familiar to most of you but I will list some of the reasons that I hear from students and practitioners alike that serve in their minds to justify a philosophy which is, to say the least, not consistent with conventional economic thought:

- forest systems are too complex for rational, analytic approaches which attempt to deduce or infer how such systems will react to considered intervention or manipulation (we simply don't know enough about these systems to reason from action to consequence with any degree of reliability);
- standard economic objectives are too short-term for forest resource systems where tactical planning is considered as planning for the next three to five years and strategic planning is for actions decades into the future;
- forest resource systems are subject to risks and uncertainties that are difficult or impossible to model and consider in any objective decision-making framework--only experience will serve as an appropriate and reliable basis for decision making in such situations;
- economic and other anthropocentric decision approaches don't deal with the long-term considerations that are necessary in the management of forest resource systems--biocentric approaches better represent the long-term requirements of society as well as the intrinsic values of the resource system; and
many of the values associated with the ownership, use, and management of forest resource systems are intangible, not valued in the market, or are collectively incommensurate--this makes quantification difficult or impossible at worst and misleading and inappropriate at best.

Most of us would admit that many of these difficulties are real and do in fact pose significant problems in the application of rational, systematic and quantitative approaches to the solution of real problems in forest resources management and economics. However, most of us also believe that these difficulties are not completely insurmountable. In fact, it is these difficulties, together with the our judgement about the importance of planned management actions, that make the field interesting and challenging.

EARLY ATTEMPTS TO INTEGRATE RESOURCES MANAGEMENT AND ECONOMICS IN A DECISION MAKING FRAMEWORK: THE SAF-NSF CURRICULUM DEVELOPMENT PROJECT

In the late sixties and early seventies there was a concerted effort to integrate forest economics and resource management in a decision making context: the SAF-NSF Joint Curriculum Development Project. I was just starting my academic career and was privileged to work in this effort with a distinguished group of forest economists, managers, and biometrics-systems analyst types. This group included Bill Duerr, Sam Guttenberg, Dennis Teeguarden, Henry Webster, Larry Davis, Jay Hughes, Ken Ware, Niels Christensen, Jerry Clutter, Brian Turner, Bill Hafley, Bruce Bare, Otis Hall and others. Those of us with a strong quantitative bent really believed that this effort represented an opportunity to make the field of forestry more rationally-based and objectives centered. We believed further that the then fledgling field of management science provided the best vehicle for teaching forest management and economics in ways that would inculcate this approach in students.

Capstone courses were developed all over the country that integrated forest resource economics, management, and, presumably appropriate biophysical knowledge about forest resources, in a decision-making framework. At many schools, this framework was developed in an operations research context and was taught by the most quantitative faculty in the school. Over time, these capstone courses have evolved in different directions and now may or may not serve the original intended purpose. Judging from the attitudes and practices of graduates over the past twenty years, there is little convincing evidence that we have significantly improved the view of the profession as a whole toward rational and economically-based approaches. This failure is probably the result of many factors. Today, I want to consider only those issues related to what we teach in integrated resources management courses and, in particular, those issues related to how we teach these subjects.

FOREST RESOURCES ECONOMICS AND MANAGEMENT IN THE UNDERGRADUATE
What should be taught in forest resource economics and management? While there is plenty of room for argument here, the concepts, tools, and principles that I believe should be taught in this area include (by area):

**Economics and Resource Economics**

- General equilibrium: supply-demand relationships; the relationships between the concepts of general economics and forest resource economics;
- Investment analysis: the concept of opportunity cost and of the opportunity cost of capital in particular, the calculus of finance, investment, and benefit-cost analysis; externalities and their treatment through market and regulatory mechanisms;
- Welfare economics: community stability, employment, and other welfare considerations in resource economics, including demographic and inter-generational equity considerations; and
- Production economics: the economics of production when the raw material supply is a renewable natural resource, and the relationships between renewable and non-renewable resources.

**Resource Management**

- A systems approach to resources management: goals, objectives, and alternatives in resource management; economic and other decision criteria for the assessment of alternatives in terms of stated goals and objectives, modeling systems outcomes, operational, economic, and resource limitations or constraints on the design and selection of feasible management alternatives; optimization in single and multiple objective situations;
- General considerations in renewable resources management: the regulation or control problem with and without sustained yield constraints (asset liquidation); conversion from an unregulated initial state to an optimal or specified steady-state condition;
- Management planning: the incorporation of spatial or geographic information into the management planning process; strategic and tactical planning, including hierarchical approaches;
- Implementation and administrative management considerations in resources management: organization, communication, and control; monitoring results and direction; feedback and management control.
Ideally, we should probably teach these subjects so that students could analyze the arguments we started with about why the rational approach often fails to be appropriate in forestry. Students, through analysis, should be able to arrive at their own position about the utility of resource management and economics. Whether this material is best taught in the framework of an integrated capstone course or is best taught in separate courses probably depends more on the personalities of the faculty involved than on anything else. Team teaching is an enterprise fraught with problems in the view of many faculty and it has been difficult to manage in the culture of the typical academic enterprise. What is more important is that the material be integrated, that the faculty separately and collectively demonstrate to students that they value integrated knowledge and problem solving approaches, and that the respect the knowledge and approaches of their peers.

ALTERNATIVES FOR TEACHING FOREST RESOURCE ECONOMIC AND MANAGEMENT

A widely-employed model for curriculum development-- The Tyler Model-- stresses that curricular objectives should be developed from considerations of the needs of the discipline or profession, the needs of society that the profession wishes to serve, and needs and attributes of students who enter the discipline. While faculty are usually naturally attentive to the first two parts of this model, we often do not fully consider the intellectual characteristics of the kinds of students that enter the forest resources fields in either curriculum development or in the development of instructional strategies. On the basis of my experience in teaching forestry in several institutions the majority of students who enter forest resources can be characterized as follows:

- they tend to be more pragmatic and career oriented than theoretical or academic;
- they tend to be more concrete than abstract;
- they tend to be operate in fact recall mode rather than in analytical problem-solving mode;
- they tend to be willing to work hard at prescribed tasks if not so willing or able to think and tackle creative or less well-defined tasks; and (unfortunately)
- they tend not to read carefully and critically.

Let me hasten to add that I am not saying our that students are not capable; on the contrary, they can be quite able when properly taught and motivated. They are probably in fact not greatly different in most respects to students who enter many other generally conservative or applied fields (agriculture, geology, engineering, etc.). However, we have not been particularly willing in most of our teaching to adapt material to their capabilities and take them as far as we can and should. We also have not thought seriously about which of these attributes we should take as fixed (and therefore as characteristics that should be accommodated in our teaching) and
which attributes we should take as characteristics that can be effectively modified with proper
instruction. For example, if students are not naturally systematic, logical, and rational in their
general approach to problem situations, we have to be realistic in terms of how much change can
be induced through learned behavior. Lord Peter Medwar, in his book *Advice to a Young
Scientist*, advocated that all that was necessary to develop productive scientists was training in
logic, the scientific method, and requisite disciplinary knowledge. He subsequently modified his
beliefs to place greater emphasis on the importance of innate creativity, curiosity, and ability to
reason in the abstract. There is a danger that teaching logical problem solving methods by rote
may be much like the experiment of trying to produce great literature by introducing monkeys to
word processors.

Instructional strategies for teaching abstract ideas and reasoning to students of forest
resources should be developed to take advantage of or compensate for the attributes of the
majority of our students. Ideally, we would teach in ways that would recognize the full range of
learning styles and attitudes among students but that skill is beyond all but the most gifted
teachers. If the majority of our students are predisposed to be pragmatic and concrete, then the
way we teach important areas and topics that are intrinsically mathematical or abstract
(probability and statistics, systems modeling, marginal analysis, mathematical optimization, the
general theory of equilibrium, dynamical modeling of forest resource systems, etc.) should be
designed so that this disposition is accommodated and not ignored. In teaching these kinds of
topics (and probably many others as well) the following approaches should be considered:

- Take care to insure that a proper motivational foundation is laid before difficult topics are
  introduced—what may seem obviously important to you (because you already understand
  the context or because the idea has clear intellectual merit) can appear unnecessarily
  abstract, esoteric, or even arcane to the student. Placing the concept in context will
  motivate students to make the effort to learn and appreciate the idea. Don't assume that
  just because the concept is obviously important to you and your peers that it will be so to
  your students. Spend some time to place the concept to be introduced in context in the
  framework of what you are trying to accomplish in this entire area of instruction and in the
  framework of the course and curriculum of study as a whole. While obviously this
  approach can be overdone, it takes surprisingly little time to accomplish if it is done as a
  natural and systematic part of your teaching.

- It will generally be more effective to introduce ideas and techniques through appropriate
  verbal description rather than by symbolic description. It is hard for those of us who are
  at home with the specialized and efficient notation and jargon of our specialty to avoid
  using this approach in teaching but my experience indicates that we unnecessarily
  complicate and obscure concepts when we use the natural terminology of the discipline.
  While it is usually our objective to take students to the point where they can think and
  reason in the language and syllogism of the field, we should consider whether or not this
  is a reasonable objective when teaching students who are not going to become specialists
  in our fields. We should consider that teaching students at an introductory level is quite
different than teaching students who will major in our specialties. For example, an
introductory course in physics could be taught in an interesting and intellectually honest
manner by explaining and connecting the fundamental concepts of modern physics in
descriptive ways. The traditional approach of teaching physics by requiring students to
solve simple problems in heat, mechanics, light, and sound is a lost cause for most
students (they will almost never have the skill or interest to attempt the solution of these
kinds of problems in real life) but understanding and appreciating the synthetic nature of
physics and its role in the modern world is clearly important and can be achieved with an
appropriate pedagogy. Remember that the main purpose in teaching at the introductory
level is not to proselytize students for our discipline.

• Don't mistake arithmetic or other kinds of mechanical drill for an understanding of
  conceptual foundations. In forest economics students often spend a great deal of time
doing the arithmetic of finance without ever really knowing why they are doing this. Don't
we really want our students to understand the time value of capital assets and the
relationship of this value to opportunity cost, supply and demand relationships, and
inflation rather than an understanding of the use of (to them) complicated formula for
summing series and progressions?

• In a similar vein, utilize up-to-date methods for the numerical solution of problems.
Statistical packages, spreadsheets, computer graphics packages, and other standard
software often obviate or obsolete (we probably believe thankfully) calculational methods
that were originally developed out of need rather than out of the necessity of
understanding. You really don't have to know how to invert a non-singular matrix or
actually do the simplex procedure if you understand and appreciate what is going on with
these methods. I think that is usually easier to teach the concept than to teach the method
and teaching only the method is certainly no guarantee that the concept will be apparent or
understood.

• Use interesting, realistic, but tractable examples and cases to illustrate and explain
concepts and principles. Develop and use case study approaches for appropriate topics to
make instruction understandable, interesting, and efficient. To be sure, it takes more than
a little bit of creative energy to develop appropriate cases, documentation, problem
assignments, and even good exams that teach as well as test. It is not asking too much of
college faculty that they employ creative methods in teaching as well as research— it is
only through such an investment of your efforts and abilities that the real connection
between scholarship and teaching can be made.

• Finally, test students in ways that test their understanding of concepts and ability to
integrate knowledge within and across courses. Make students write explanatory papers
and reports and require oral presentations. Grade the reports and presentations for style,
grammar, spelling, and effectiveness of presentation as well as for content.