Rethinking Educational Models for Natural Resource Students*

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Abstract
In recent years there has been concern expressed over declining enrollment in forest engineering and operations graduate programs. Additionally, there has been increasing debate about the nature and organization of future natural resource education in general. Central questions include: How do we balance breadth versus depth of knowledge in our students? Are the knowledge and skills sets necessary for professional success in management versus research disparate and divergent, or congruent and complementary? Should separate educational tracks be developed for students interested in these different career paths? If differentiation should occur, should it begin at the undergraduate or graduate level? How do we achieve integration across disciplines in addressing management and research problems? Should we promote interdisciplinary students, interdisciplinary research teams, or continue to focus on disciplinary training and specialization? How do we facilitate integration of our students into the broader society they serve? In preparing students for success as researchers, how do we balance the growing social and political emphasis on research directed to problem solving with the institutional trajectory of specialization that traditionally has rewarded contributions to basic science and the scholarly knowledge base rather than contributions to society directly? These questions are not new, but the social and political context in which they occur has changed dramatically in recent decades. Educational institutions must correspondingly evolve and adapt if they are to continue to function successfully in society.

1. INTRODUCTION
The future of forest engineering graduate education has been sporadically discussed over the past decade. McNeel, Stokes, and Brinker (1999) discussed declining graduation rates in forest engineering and forest operations graduate programs across North America. The authors’ recommendations for countering this trend include more effective promotion of the profession as a viable career path and increased funding to support graduate education in forest engineering and operations. While these are key issues in the future of graduate forest engineering and operations education, we believe many of the issues facing the discipline are the same as those facing other forest resources graduate programs and include structuring graduate programs to better fit individual students career goals and aspirations, ensuring the relevancy of research questions, and balancing multidisciplinary/interdisciplinary breadth with disciplinary depth.

This broader conversation was continued at the January 2006 National Association of University Forest Resources Programs (NAUFRP) summit “Forest Research for the 21st Century: Defining strategic directions and rebuilding capacity” where graduate education and funding models pertaining to all forest resources programs were discussed. Of the three main

questions asked during this summit, one was “What knowledge, skills, and qualities will the next generation of natural resource professionals need?” The response to this question included the following skills and qualities:

- Depth and technical competency in a discipline
- Understanding of other disciplines
- Holistic view of issues, problems, and solutions
- Quantitative and qualitative analysis skills
- Ability to communicate effectively to non-scientific and scientific audiences
- Cultural sensitivity founded on academic and real-world experiences
- Awareness of the impact of research on society
- Collaborative skills with knowledge of conflict resolution

While all of these skills are important, it is unlikely a single graduate degree/program can satisfy all items listed above.

An additional recent conversation on the substance of forest resources graduate education has been aired in a series of editorials in *The Forestry Chronicle*. Innes (2005) expressed a concern over the current emphasis of depth (disciplinary focus) over breadth and recommended an interdisciplinary/multidisciplinary education model. Anderson (2005) replied with his belief that there exists a distinction between the educations needs of managers and of researchers, stating that “forest managers first communicate the problem to researchers, who then work together to find solutions” (p. 786). Further, Anderson stated his belief that sufficient interdisciplinary training occurs at the undergraduate levels and therefore is not needed at the graduate level. Instead of multidisciplinary training, graduate students as specialists should be able to work in interdisciplinary teams to solve complex problems.

While these discussions are not new, the context within which we operate as educators has changed over time. Across the spectrum of forest resource graduate education, the very nature of graduate students is changing. Increasingly, individuals are finding that management-level positions require at least a master’s degree. This has widened the scope of outcomes students are seeking from a graduate education.

As noted by McNeel et al. (1999) targeted government funding for research in forest engineering and operations has declined. Therefore, in order to conduct forest engineering and operations research under government funding programs, our work must often be only a portion of a larger research question, necessitating a multi-/interdisciplinary approach to solving broad research questions. This is coupled with an increasing emphasis on the policy and decision-making relevance and/or technological products produced under government funding programs. The decrease in government funding has meant that the reliance on private sources of funding, which has traditionally put more weight on the relevancy and applicability of results, for forest-related research has increased.

2. PROPOSED MODEL

We propose a flexible model of graduate education that is appropriate for forest engineering and operations graduate programs as well as forest resources programs in general. This flexible model includes disciplinary grounding, an understanding of science at an interdisciplinary level, and an understanding of how science interacts with society.
We believe that moving entirely to a multidisciplinary model for graduate education as proposed by Innes would be counterproductive. The grounding of a student in a specific discipline is an inescapable reality, is useful to the student, and is a productive component of a graduate education. This grounding can be achieved in a number of different ways, from undergraduate education, work experience, or coursework and will be different for each student.

Second, we believe an understanding of science at an interdisciplinary level is important for all graduate students. Traditionally this has been a component of doctoral programs, but not necessarily master’s-level education. If graduates of our master’s programs are the individuals who will likely be deciding on the relevancy of research proposals and results, we will serve both the student and the profession well by instilling an understanding of what science is early and at a broad level.

Third, students should develop an understanding of how science interacts with society. This is a key skill required in the development of relevant research questions and practical solutions to problems posed by society. This demand of relevancy is increasingly required by most funding programs.

This proposed model needs to be flexible enough to accommodate specialists as well as generalists, managers as well as academics (contrary to the thoughts of Anderson). There are numerous paths individual students can take to gain the three broad skills listed here. Therefore, the implementation of such a model requires great trust between faculty members within a program.

3. CONCLUSION

We believe this flexible model for graduate education will help to recruit and retain students within forest engineering and operations programs by better integrating forest engineering research into larger issues faced by society and the profession of forest management. This broadening will likely attract a greater variety of students who may not look at a narrowly-focused forest engineering graduate program. Additionally, by allowing flexibility in graduate programs, we will be able to serve the ever-widening scope of educational needs of our students while at the same time increasing the relevancy of the research we conduct.

4. REFERENCES
