**Comments**
**by Jo Ellen Force, Head, Department of Forest Resources, University of Idaho**
**on the panel *"How Should Educational Institutions Respond?"***
**RNRF/AAAS "Conference on Personnel Trends, Education Policy and Evolving Roles of Federal and State Natural Resource Agencies"**
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My presentation today will address the education challenges facing natural resource university programs in three areas: undergraduate education, graduate education, and mid-career continuing education for natural resource professionals.

First, as we revise, re-invent and develop new professional natural resource programs to meet changing societal needs, one of the most critical questions is: During the 4-5 years students will spend in higher education institutions seeking professional natural resource baccalaureate degrees, what is the right balance between general education and "vocational/professional" training? For example, is art history (often a university humanities requirement) more important than another three credits of silviculture for the professional forester? How important is it that foresters understand the role of art in forming people's perceptions of what is a "natural" forest?

The question of balance between "education" and "training" is particularly critical for accredited programs, such as forestry. There are forest technician programs at many community colleges. At many university forestry programs, nearly half of the BS graduates transferred into the accredited forestry program – often from technician programs, sometimes for other associates degree programs. Those coming from forestry technician programs usually do not have the basic science, math and university general education courses. In BS-degree accredited forestry programs, most of the professional forestry courses build on a solid understanding of biology, chemistry, physics, mathematics, statistics, and good written and oral communication skills. The focus in silviculture, for example, is on the forest ecosystem and ecological principles and *why* the forest will respond in certain ways when specific management actions are taken. In technician programs, the emphasis in silviculture is on "how" to do a seed tree cut, e.g., and other field skills, not on underlying theory and principles. Another "balance" question is the emphasis on skills for that first job versus the broader management and policy expertise they will need for that professional position they hope to have after 5-10 years of experience.

Professors have no trouble adding courses to a curriculum as they examine what a student really needs to know to be successful in a natural resource career. But, taking courses out of the curriculum is very hard. Many natural resource curricula have more than 90 percent of the credits needed for a degree as required credits – leaving almost no electives. Thus, many students who transfer into the program, whether from another major in the university or from another institution, or have some interest in art or music or in learning a foreign language, e.g., must extend the time and number of credits for the BS degree beyond four years.

Other questions related to all education, but especially difficult at the undergraduate level, are related to the *process* of teaching and learning, rather than the content, and are not unique to natural resource education. They include: How do we to effectively teach critical thinking, problem solving, and the ability to evaluate and identify reliable, valid information (especially on the web in this information-rich era)? What teaching methods are most effective with today's students – who grew up on MTV, video games, and computers? The student population is much more diverse, especially with respect to learning styles and learning disabilities being recognized. Today's college student is not just those "geeks" and "nerds", like their professors, who have always succeeded under the traditional lecture and exam paradigm.

Integrated, collaborative teamwork is critical to becoming successful natural resource professionals today. This requires very different educational experiences than most professors experienced when they were in college. Teamwork skills, such as conflict management, negotiation, listening, etc., as well as excellent communication skills and interpersonal skills are essential. This classroom environment is hard to achieve and a challenge to professors and students as the evaluation and grading system is still individualized – with as much pressure as ever on achieving a high GPA in a tight, competitive job market.

Finally, especially for undergraduates, the changes in the educational environment I've described require professors, as they develop educational programs, to carefully evaluate the trade-offs between teaching/learning the "facts" that are believed to be essential to effectively understand and manage natural resources today with providing opportunities in the classroom for students to become effective learners. Do they know how-to-learn? Do they know how to ask the right questions to find the right information to answer the questions?

Now, let us move on to graduate education. Many of the challenges facing undergraduate education are also present in graduate education, but with a slightly different focus. The Masters degree has become the entry level degree in many natural resource fields, especially wildlife, ecology, resource recreation, and, in many cases, forestry. Should a university program offer both a course-based, "MBA" type management Masters degree as well as the traditional thesis research degree, which is often preparation for doctoral research work and a research career? How should limited financial and human resources be distributed between such programs? How do we prevent the development of a two-class system among graduate students when most professors prefer to direct students in the thesis research degree?

The National Science Foundation has recently begun a doctoral research fellowship program in Integrated Graduate Education Research and Training (IGERT) as one response to the depth versus breadth question for doctoral work. Such programs are especially attractive to natural resource professionals as natural resource problems today are complex and require specialists from may disciplines to work together in an integrated research environment. These graduate programs require professors to work under very different paradigms for research than has been the accepted and proven model for graduate education in this country for decades.

The National Research Council report on "National Capacity in Forestry Research" identified several areas of critical needs in forest science. University forest science programs are seeking to address these areas and working with USDA/CSREES as well as others in this endeavor.

The last educational area I will briefly touch on today is that of continuing education for mid-career professionals. Many universities are developing "certificates" for training in new technologies, such as remote sensing and fire models and stable isotope analyses. Distance education technologies are providing web-based courses and other on-line courses for professionals without coming to the campus. Universities are attempting to provide educational opportunities for these professionals by scheduling around their work and seasonal schedules while at the same time working around the on-campus academic calendar.

My brief comments today are but the tip of the iceberg regarding the changes taking place in higher education today, the challenges we all face, and the opportunities to prepare the natural resource scientists and managers of the future. We in the universities look forward to working with all of the public agencies and private employers at this conference and throughout the natural resource arena to help provide the well-educated, professional personnel you need.