University undergraduate curricula in wildlife: beyond 2000

by William J. Matter and Robert J. Steidl

Abstract
Educational content and the practices of wildlife educators must change deliberately, not inadvertently, to best serve students, employers, and the profession. The first priority of university faculty is to help students explore new ideas and worldviews and become informed citizens, self-learners, and critical thinkers. University programs should not merely train students for careers. There is no one ideal curriculum in natural resources, and wildlife programs will continue to vary in focus, strengths, modes of course delivery, and regional flavor. However, wildlife professionals should identify a fundamental set of knowledge, skills, and competencies expected of all undergraduate wildlife students. Fostering candid and constructive exchange among faculty, students, alumni, and employers concerning these competencies is a challenge we must meet. We caution against the false dichotomy that students can either master more facts or master synthesis and critical thinking. Students need to do both. Development of a core curriculum with a mix of single-discipline courses (e.g., plant taxonomy or basic ecology) and courses in which a primary goal is integration across disciplines may be a way to increase breadth without weakening basic competencies. Education of wildlife professionals should become more of a shared responsibility among all interested parties—students, employers, and educators.

Key Words
curriculum, education, natural resources, teaching, wildlife science

Educational content and the practices of educators must change deliberately if they are to remain effective and viable. Even in the absence of genuine planning, forces act to promote and resist change in university undergraduate programs in wildlife science. Emerging technologies, like geographic information systems (GIS) and electronic information retrieval, and the hiring of new faculty, for example, promote incremental changes in curricula. In time, however, these incremental changes, especially the addition of new specialized courses, can result in programs of study that: 1) offer few opportunities for elective study, 2) become difficult to complete in 4 years, 3) deviate from the original “vision” for the curriculum, 4) become less integrated with other disciplines, and 5) increase breadth of knowledge at a cost of decreased depth of knowledge. In contrast, forces that work against changes in existing curricula include requirements for civil service positions, certification requirements of professional organizations, resistance of established faculty to change course content and teaching style or to embrace emerging disciplines and technologies, and employer demand for applicants with traditional skills and competencies.
Educators, employers, and students have a vested interest in the education of wildlife professionals, so we feel it is appropriate for each to participate, apart and jointly, in occasional introspection and discussion about curricular content and practices. We believe that curricular changes should be made through deliberate choices and thoughtful review, when possible, or at least that the impact of accumulated incremental changes be assessed occasionally. In this paper, we raise issues that we and other natural resource professionals believe should be part of such a review process and make suggestions to improve undergraduate curricula in wildlife science. We focus on works published in the past decade, but most issues have been discussed over the past several decades.

**The university experience**

The primary focus of American universities historically has shifted from general intellectual development of undergraduates that were a small proportion of high school graduates, to utilitarian training in support of national growth, and to development of technology and conduct of research, especially graduate research (Bok 1990, Boyer 1990). Today, faculty, students, and employers sometimes need to be reminded that the first priority of university faculty across campus is shifting back to the intellectual development of students. Foremost, the university experience should help students to explore new ideas and worldviews and to become informed citizens, self-learners, and critical thinkers. That is, university programs should seek to educate students rather than merely to train them for specific careers or professions (Brouha 1995, Orr 1999). The perspective of the student as self-learner is increasingly important as students are expected to accept greater responsibility for developing philosophies and values that are compatible with the rapid globalization of society and the explosion of information available about our world and universe. Perhaps more pragmatically, graduates are more likely than ever to change professions and to need substantial post-collegiate learning throughout their lives as their profession changes beneath their feet. A baccalaureate degree in wildlife science (or any science) should prepare students for these lifelong challenges at least as well as do other undergraduate degree programs. A curriculum focused too narrowly on professional training and accumulation of facts and techniques risks compromising the intellectual and philosophical development of students. Faculty should "...teach enduring principles rather than technologies subject to obsolescence..." and should resist temptations to trade away "general education" requirements for career-focused courses (Brouha 1995).

**No ideal curriculum**

The belief that there is one ideal curriculum in natural resources and that there is a formula for developing the ideal curriculum is unrealistic (Manning 1998). Regardless, faculty bear the lead responsibility to develop the best curriculum possible, given the balance of available resources on campus, composition of the student body, and expectations of current and potential future employers. Rightfully, wildlife programs will continue to vary in focus, strengths, modes of course delivery, and regional flavor, and there should be "truth in advertising" about these differences. Despite differences in individual curricula, we believe that wildlife professionals should hold sacrosanct a fundamental set of knowledge, skills, and competencies expected of all undergraduate wildlife students. With the mounting need for increasing the breadth of wildlife programs, the likelihood of abandoning some of this fundamental knowledge may prove deleterious, perhaps analogous to building a house without first establishing a solid foundation. But which knowledge, skills, and competencies are essential?

**So much to learn, so little time**

Intellectual demands on resource scientists and students are growing in scope and depth as the analytical abilities and knowledge required to answer scientific questions continue to increase (Hard 1995). Because of the increased complexity of addressing these concerns, there is a strong temptation to inundate students with endless detail and techniques, an approach that may foster a myopic view of their field (Hard 1995). Many natural resource educators believe that undergraduate curricula need to offer increased integration of courses and disciplines; more perspective on larger ecological scales (e.g., ecosystem and global); more background in economic, social, and institutional processes; improved communication skills; and increased experience working in teams (e.g., Cortner 1992, Adelman et al. 1994, Ritter and Blackmon 1994, Nielsen and Decker 1995, Taylor et al. 1995). In part, we agree, but caution that these changes should not compromise essential competencies.
Obviously, with this increased demand on existing curricula, some existing courses or study units must yield. To further exacerbate this conflict, many institutions are under pressure from legislators, parents, and administrators to reduce the number of units required to complete programs of study to shorten time to graduation. Romesburg (1991) recognized this dilemma and warned educators not to view students as vessels to be filled with facts and principles, because the volume of instructional material will always grow beyond available instructional time. He suggested that students be encouraged to think in a variety of ways, especially scientifically. Although we agree, we caution against creating something of a false dichotomy: expecting students to either master more facts or to master synthesis and critical thinking skills. Clearly, students need to do both. They need information, an increasing amount, to have the foundational materials about which to synthesize and think critically. However, students need not gain most of their information via passive transmission in lectures. The current emphasis on helping students become “active learners,” wherein mastery of essential facts and principles can be a natural byproduct of problem-based inquiry (or other types of active learning), is consistent with the challenge (Orth 1995). In fact, some of the most dramatic changes in wildlife curricula in the future may involve the ways in which students encounter information rather than the information itself. We should provide students with the means to learn new “content” on their own, as inevitably will be necessary in their futures. Again, we should encourage students to become self-learners and problem solvers, a paramount goal of higher education. An alternative to creating new courses to strengthen student competencies outside of traditional sciences and management (e.g., in the social sciences, communications, and cooperative decision-making) is to better integrate these new materials into the existing course structure in resource sciences.

Integration across disciplines

Most wildlife programs are housed in larger academic units that offer other natural resource curricula such as fishery, forestry, rangeland, and watershed science. Integrative and multidisciplinary learning can characterize studies across these natural resource disciplines or characterize the infusion of materials from more distantly related disciplines, such as political and social science, economics, statistics, and decision theory. Both types of integration are increasingly necessary for students of natural resources. Some wildlife curricula are inherently multidisciplinary, wherein students are required to complete courses in resource disciplines outside of wildlife (e.g., range, recreation, and forestry science). However, in this model, students themselves often are responsible for integrating these materials, as integration rarely is a fundamental goal of each course. The menu of course requirements for certification by The Wildlife Society (TWS) aligns with this curriculum model.

Several interdisciplinary curricula in natural resources have been developed recently. For example, courses from 4 colleges (agriculture, forestry, liberal arts, and science) were combined into a programmatic addition to the “traditional strong programs in forestry, range, recreation, fisheries, and wildlife” at Oregon State University (Jensen et al. 1998). Jensen et al. (1998) noted that a strength of this curriculum “…is that it crosses the traditional natural resource disciplines without weakening those disciplines…”

This model promotes 2 “tracks” for natural resource education: a traditional, single-discipline track, focusing on science and management, and a multidiscipline track stronger in liberal arts, communications, and social sciences but weaker in physical and biological science. Such a multitrack model raises several important questions. Even if these “tracks” or “options” seem appropriate for natural resource education, will this model remain appropriate for wildlife education in the future? Do we want to foster development of wildlife scientists who are primarily social scientists and relatively weak in biology and other basic sciences? Students who are strong in biology and sciences but weak in social science? Students who are strong in quantitative ecology, modeling, and GIS but weak in biology and science?

An alternate model is natural resource education based on a “core curriculum” (Table 1) that is shared by students majoring in any of the disciplines represented (e.g., fisheries, forestry, range; Matter 1996; Manning 1998). Development of such a core curriculum involves some single-discipline courses (e.g., plant taxonomy or basic ecology) with requisite content for all students in the overarching natural resource curriculum. For other courses in these core curricula, a primary goal is to include some level of integration across disciplines within natural resource science and management and within the social sciences. This type of integration is an attempt to increase breadth without weakening basic competencies.

Establishing core competencies

Current curricula often fail to produce graduates who are scientifically literate. If creating scientifically literate graduates is a goal of an undergraduate education in wildlife science, there may be a need to restructure these curricula (Romesburg 1991, Hard 1995). Some authors suggest that this goal would be better met by broadening...
and deepening education in basic physical and biological sciences (Romesburg 1991, Hard 1995). This would include studying the philosophy of science and a focus on development of a strong conceptual foundation that includes critical-thinking and problem-solving skills. Students need more practice developing hypotheses and tests, designing experiments, articulating the logical consequences of theory, and using the quantitative skills needed to deal with topics in population genetics, population dynamics, and other aspects of quantitative ecology. These suggestions were targeted for students planning to become scientists rather than resource managers or “specialized workers” (e.g., animal-care specialists; Hard 1995). However, Romesburg (1991) stressed that proper management is so strongly linked to understanding of natural systems that progress is hindered by the scientific shortcomings of all types of resource professionals. Thus, basic competencies for future resource managers may not be much different than for future resource scientists.

Curriculum development should be based on an inventory of desired knowledge and competencies for students. Faculty at the University of Arizona and the University of Vermont, for example, have developed curricula built around a core of knowledge and skills thought necessary for all students of natural resources. Disciplinary specialties (e.g., fisheries, wildlife, range) are developed largely outside the set of core courses. To create a list of expected student skills and competencies, faculty of each university participated in “vigorous discussion, debate, and deliberation” (Matter 1996, Manning 1998). This level of interaction among faculty is in marked contrast to the high level of autonomy traditionally practiced by faculty in developing instructional content and format. Fostering candid and constructive exchange among faculty surely will be a challenge we must meet in curriculum development for the future. We see, however, no viable alternatives to a committed discussion as to what comprises the essential components of a curriculum and a well-prepared scientist. Input on proposed changes to curricula from students, alumni, and employers also must be sought, considered, and, if valuable, accommodated. Eventually, certification requirements of TWS should be reviewed in light of such systematic efforts to identify core competencies.

**Conclusions**

Student credit-hours for a baccalaureate degree often are distributed across university general education requirements, basic science and mathematics requirements, “core” requirements of a natural resource curriculum, and requirements and electives focused on wildlife-related subjects (Table 2). Given that courses focused most directly on wildlife subjects probably make up no more than 20–30% of any curriculum, a 4-year program in wildlife science can never hope to fulfill the ideals of all students, faculty, and potential employers. We suggest that education of wildlife professionals should become more of a shared responsibility among these interested parties.
Employers

Students would benefit, during their university tenure, from more types and more opportunities for pre-professional experiences. Employers committed to the development of superior future employees should strive to create new and innovative ways to expose students to demands of the modern workplace. These experiences might include traditional internships, cooperative education assignments, and summer employment, but also may include sponsorship of undergraduate research, low-cost workshops aimed at undergraduates, and interactions with student chapters of TWS. Employers will have to acknowledge that some types of specialized training cannot be accommodated in a baccalaureate program and should be learned during employer-sponsored training sessions at the time of hire and throughout the careers of professionals. These should include opportunities for professional development and other mechanisms for further education, even if temporary leaves-of-absences need to be negotiated. Some agencies already provide or require continued education and training of employees as one way to foster continued growth, but surely more can be accomplished. Clearly, employers also should be invited to participate in curriculum review at universities.

Students

Students must develop a commitment to lifelong learning and accept a growing, continuous responsibility for self-improvement. Students must be willing to participate in new approaches to active learning, even if their first experiences are uncomfortable or poorly administered. Students must seek out-of-school experiences that will help bridge the inevitable gaps between academic learning and career practicalities, a recommended and successful practice in wildlife science. Students will benefit from being as active as possible in selecting courses, seeking faculty mentoring, and interacting with peers and wildlife professionals. The student—professional mentoring sessions at TWS Annual Meetings have been a successful format for bringing educators, researchers, and students together for advice, networking, and exchange of ideas. We encourage students and professionals to participate in these kinds of sessions, and to help infuse their creative ideas for improvement.

Faculty

Faculty must rededicate themselves to providing a rigorous and challenging environment that encourages a variety of learning modes and calls for a full spectrum of intellectual outputs from students. Faculty must be willing to surrender some autonomy and develop avenues of exchange and cooperation with other faculty involved in natural resources education within their institution. Faculty should work toward partnerships with employers to foster mutual understanding of the challenges and potential improvements to undergraduate education.

Together we can move closer to the goal of making available "...people with the broad education and analytical skills that provide the profession with the resources to distinguish between the tired and the novel, the immaterial and the relevant, and the trivial and the profound" (Hard 1995). Surely this type of "human capital" will also give us great power to see through problems in resource management, and provide many personal rewards to participants in the process.

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