

**The Wildlife Society Ad Hoc Committee on  
Collegiate Wildlife Programs**

**Summary Final Report  
To The Wildlife Society Council**

**September 2009**

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## **‘Bullet-List’ of Highlights from the Collegiate Wildlife Programs Ad Hoc Committee Report**

### Inventory

- Approximately 4 times as many programs offering wildlife education exist in North America than TWS had previously listed, with increasing emphasis on including wildlife in non-traditional (Environmental) programs
- The linkage between today’s wildlife programs and TWS and its mission and goals is generally not strong

### Program Changes

- Wildlife programs have increasingly changed their names from Game or Wildlife Management to Wildlife Conservation, Wildlife Ecology, and Natural Resource Conservation
- Students enrolling in today’s wildlife programs have had little experience or background with field work, natural history of organisms, wildlife-habitat relationships, and consumptive or non-consumptive uses

### Drivers of the Changes

- Curricular and program changes are most often tied to interrelated factors, including institutional demands, program-specific requirements, training needs expressed by the profession, and student background and experience
- Each of these can be affected by such components as credit hour allocations, national and international standards, declining budgets, increasing costs for institutions and students, and non-traditional backgrounds of students

### Theory vs. Practice

- A strong foundation in basic science and ecological theory needs to be complemented by providing opportunities for an understanding and appreciation of the North American Model of Wildlife Conservation, the role of wildlife and habitat management, conservation being comprised of more than just research, and political realities of managing wildlife populations
- Flexibility of programs, students, and employers is needed, as well as a commitment for life-long learning in professional growth and development

### Course Work vs. Experience-Based Learning

- Experiential learning has been proven to be effective in a wide variety of areas, with innovative tools becoming widely available at reasonable costs
- Some university and college programs are taking advantage of these opportunities, but others are not due to time and budget constraints

### Desired Competencies and Perceived Proficiencies

- Gaps remain between academic faculty and potential employers of wildlife program graduates
- Proficiency in oral and written communication and teamwork is perceived to be less than desired, and therefore agencies and academic institutions need to work more closely together to bridge the gaps

### Customers and Customer Needs

- Most graduates find employment with state/provincial and federal wildlife agencies and non-government organizations, and their needs have become more varied as more emphasis is placed on collaboration, transparency in decision-making, and systems-based approaches to management
- Universities/colleges cannot define their programs without input from employers, and employers cannot place unreasonable demands on academic institutions and/or graduates from programs – thus recognition that graduation is only the beginning of the second phase of a long and continuous educational road is needed by all parties

#### The ‘Ideal’ Wildlife Program

- Although there is probably no single perfect wildlife program, and recognizing that the master’s degree is the typical entry-level credential, TWS certification requirements for coursework represent the core areas of competency that should be present in any high-quality wildlife program, with additional emphasis placed on teamwork and stakeholders, field experience, critical thinking, and development of specialized concentration areas
- Constraints and challenges to formulating the ‘ideal’ program include diminishing resources, required core curricula, overriding importance of research dollars, and the simple inability to provide ‘everything’ a student needs

#### Encouraging Institutions

- Consider using a different educational model, one that accomplishes the transfer of knowledge (principles, methods, facts) in ways that simultaneously develop awareness, experience, and some basic skills for meeting the actual demands of chosen career paths and recognizes that more than one dimension of competence is necessary for successful entry to the profession
- This new model must consider field worthiness and hands-on training, communications and interacting with stakeholders, and interdisciplinary problem-solving and working in teams

#### Synthesis of 74<sup>th</sup> North American Special Session – Are University Curricula on Target?

- While educational institutions need to increase their focus on improving their graduates’ communication skills, ability to work in teams and to work with stakeholders, a deeper issue exists
- The entire wildlife profession must be involved in preparing future wildlife professionals for the complex, interdisciplinary, ecosystem-based jobs in wildlife conservation
- Professional societies should re-evaluate and regularly update their certification programs to ensure that they define the competencies needed to be an effective wildlife professional
- Universities that wish to provide comprehensive wildlife programs should ensure that their students can meet certification requirements
- Employers must stay engaged in curriculum discussions and support research and training projects and must also recognize that entry-level employees are not finished products and support their continuing professional development
- The ultimate responsibility for individual professional development, however, lies with the wildlife professional who must accept responsibility for his or her own professional development by continually seeking to improve knowledge and skills throughout his or her career.

## **1 – Introduction**

In late- January 2008, TWS President Daniel Svedarsky established an Ad Hoc Committee on Collegiate Wildlife Programs, chaired by Rick Baydack of the University of Manitoba, to examine North American University and College Wildlife Programs. The Committee was asked to determine trends, strengths, and weaknesses of wildlife education at universities in the 20 year interim from Teer et al. (1990: University education in wildlife biology: what's given and what's needed'; Trans. of N. Am. Wildl. and Natural Resources Conf. 55:126-132): who concluded that educational institutions did not always produce graduates that adequately met employer needs.

President Svedarsky also referred the Committee to Scalet (2007: Dinosaur ramblings; Journal of Wildlife Management 71:1749-1752) who discussed trends in wildlife and fisheries education and research from his experience of over 35 years. This stimulated considerable online discussion and was further considered at the Tucson Council meeting of The Wildlife Society in September 2007. Additional articles in the Journal of Mammalogy, National Academy of Science, Children and Nature Network, and by TWS member Gordon Batcheller demonstrated great interest in this topic.

Using the above materials as background and the collective experience of members of the Committee, President Svedarsky issued the following charge:

1. Wildlife programs have changed in the last 40 or so years. What have been the principal drivers of these changes in society, educational institutions, or other factors?
2. Describe the current balance between theoretical and applied wildlife biology and management that is offered at college and university wildlife programs.
3. What is the appropriate balance between formal coursework and experience and how can the latter be facilitated?
4. What role could (should?) the Certified Wildlife Biologist program of TWS have in driving the content of wildlife programs?
5. What is the relative role of: TWS, College and University Wildlife Education Working Group of TWS, Association of Fish and Wildlife Agencies (AFWA), National Association of Fish and Wildlife University Programs (NAFWUP), and other appropriate groups in influencing the content of collegiate programs?
6. What entities are hiring graduates and what are their perceived needs?
7. Develop a report with recommendations for further study on the above items.

As per point 7 of the Committee's charge, this Report has been organized into sections that address the objectives specified in the Charge (Committee members listed with Section Lead in **bold**):

- Inventory of University/College Wildlife Programs – **Mark Wallace**, Rick Baydack
- The Changing Face of University/College Wildlife Programs – **John McDonald**, Lori Schmidt
- Drivers of the Change – **Dan Edge**, Brittany Petersen
- Theory vs. Practice – **Darren Miller**
- Course Work vs. Experience-based Learning – **Tom Hughes**, Eric Pelren
- Desired Competencies and Perceived Proficiencies of Entry-Level Fisheries and Wildlife Professionals: A Survey of Employers and Educators – **Steve McMullin**, Dean Stauffer
- Identification of 'Customers' and Customer Needs – **Dave Schad**, Stacy Salvevold, Tom Hughes
- What should the 'Ideal' Wildlife Program Look Like – **Dean Stauffer**, Billy Minser, Gordon Batcheller
- How do we Encourage Institutions to Build the 'Ideal' Program – **Wini Kessler**, Billy Minser
- Synthesis from the Special Session of the 74<sup>th</sup> North American Wildlife and Natural Resources Conference: The Coursework of Conservation – Are University Curricula on Target – **Steve McMullin**, Dan Svedarsky, Shawn Riley, John Organ, Dave Schad

This Summary Report was produced from more extensive materials prepared by the authors for each Section Report. Those Section Reports are available from The Wildlife Society.

## **2 - Inventory of University/College Wildlife Programs**

### ***U.S. Programs***

We examined over 3,413 university web sites listed on <http://www.univsource.com/> (accessed 1 Jan through 30 May 2008) to initially assess programs that offered wildlife-related courses. Of these, 334 programs offered Bachelor of Science (B.S.), 184 Master of Science (M.S.), and 99 Doctor of Philosophy (Ph.D.) degrees in wildlife, related natural resources, or environmental sciences.

Program type was influenced by region. In the Northeast, 57% of programs were in Environmental Sciences followed by the West, Southeast, and North Central sections, all having about 30% Environmental Science programs. This contrasts with other regions where Environmental programs represented <18% of what was available. In the Central Mountains and Plains, Wildlife and Fisheries programs represented 62% of offerings, followed by the Southwest (56%) and North Central (53%). Wildlife programs represented only 29% of available programs in the Northeast.

Few US programs require students to meet TWS certification requirements. Although not quantified, more programs (perhaps another 25%) offer classes that would allow students to become certified but were not required for graduation. Only ~25% of programs connect students to TWS by supporting student chapters.

Variability was high regarding “hands-on” coursework, and many universities were modifying this component of their curriculum. Nearly 24% of traditional programs reported declining enrollment while only 13% of non-traditional programs reported declines. However, there was no difference in enrollment trends reported between NAUFWP and non-NAUFWP members. Programs with increasing undergraduate enrollment reported that hands-on opportunity in their programs was increasing or stable. Of those reporting, the traditional wildlife programs (NAUFWP members) had a lower percentage of hands-on curricula than did non-NAUFWP programs.

### ***Canadian Programs***

We examined 77 universities and 120 colleges to curricula relative to wildlife. College programs tended to be 1 or 2 years in length, with some offering transfer credit to the university level upon graduation, whereas University programs offer a 4-year BS along with MS and/or PhD degrees. Sixty-five percent provided wildlife-related courses. However, only 21% offered degrees or program specializations in the wildlife area. Many Canadian universities have established the ‘wildlife area’ in environment or environmental science programs and these have seen increasing enrollments in recent years. Generally, all programs offering degrees or specializations in the wildlife area have curricula available that would enable their students to meet requirements for TWS certification, but none require certification to be met. Student Chapters of TWS have been established at 4 of the 16 universities offering wildlife specializations. No Canadian university is a formal member of NAUFWP.

Of college programs, 35% provided wildlife-related courses. However, only 17% offered certificate or diploma program specializations in this area. Because programs were relatively short and focused, none of the Canadian college programs have sufficient content to meet TWS certification requirements. One Student Chapter of TWS has been established at a Canadian college.

### ***Discussion***

There are at least 4 times as many programs offering some kind of wildlife education than TWS had previously listed. There also appear to have been increases in Associates of Science and Associates of Applied Science degrees or college diplomas or certificates for training wildlife technicians or as preparation for entering a 4-year program. Traditional US programs (NAUFWP members) represent only about 14% of the programs offering wildlife related curricula. Wildlife programs in Biology/Zoology or Agriculture and Forestry/Fisheries programs have been diversifying their curricula, offering courses in natural resources management, conservation biology, toxicology, GIS, and other topics. But other programs, most notably Biology and Environmental Sciences, have also been diversifying by adding wildlife, conservation and natural resources courses to their curricula. This trend was particularly evident in Canadian universities with an increase in ‘environment’ or ‘environmental science’ programs and enrollments. Interestingly, environment-related programs in Canadian universities have been identified as a growth area and particularly so in times of economic downturn when employees tend to return to universities for retraining or professional development.

- Some US regional trends include more Environmental Sciences programs in the populated centers of the Northeast and Southeast, and West coast. Canadian programs tend to be clustered according to population density. Few US programs outside the traditional wildlife schools (NAUFWP and programs with Coop Units) focus on TWS certification requirements or support TWS student chapters. There appeared to be less hands-on training in the traditional programs. Enrollment numbers were not well correlated with amount of experiential training. Trends in enrollment were highly variable within all groups and did not differ between traditional and other wildlife schools.

A variety of reasons can be advanced for the patterns detected in the inventory. The explosion of college and university programs offering wildlife-related coursework has resulted from even distantly related programs recognizing the popularity of the field in the last 10-20 years and trying to capture some of that student market. Universities competing for students are offering what they think will attract students to their programs. Declines in student enrollment in traditional US wildlife programs may simply result from so many more choices of programs. However, perhaps because of an urban or suburban rather than rural on-the-ground background, students today might be less attracted to courses with titles like wildlife science, forestry, or watershed management. Many of the US programs offering wildlife-related curricula are not the traditional wildlife schools and are not linked with TWS, and they may not provide training that meets employment needs of the profession.

Declines in classes which require hands-on training, are resulting from the economics and liabilities of higher education. It costs more to teach a field class both monetarily and in terms of faculty time. In some cases, faculty time is “better” spent generating more research dollars due to tenure and university expectations.

### *Summary*

Rapid expansion and diversification of existing wildlife and biology programs and growth of environmental curricula by schools competing for students has led many US and Canadian academic institutions to add courses and, in some cases, entire specializations in wildlife-related areas. New wildlife focus areas are often placed in non-traditional departments where the link to TWS and its objectives may not be readily apparent. These programs, and increasingly more of the traditional programs, have not been structured to meet TWS certification requirements, and may therefore view certification as an increasingly unattainable laundry list of skills that a small proportion of potential employers see as ideal but that few require for hiring a new employee. Therefore, TWS may need to consider developing a marketing strategy that would encourage the ‘new breed’ of wildlife students to find a way to get involved and prosper within our organization.

## **3 - The Changing Face of University/College Wildlife Programs**

To understand how wildlife programs changed through time, some of the long-standing wildlife programs at universities in the US using a non-random survey of 30 colleges and universities that house USGS Cooperative Fish and Wildlife Research Units (Coop Units). These were primarily Land Grant schools that were expected to have reasonably long histories of offering wildlife-related courses, if not degrees.

Early wildlife programs, those with identifiable roots in the 1930s, tended to follow one of two models. The first was where a single faculty member was hired to teach a variety of management-oriented undergraduate or graduate courses in a forestry or agriculture school or department, often remaining the sole wildlife faculty member for several years or even decades. The second model involved the establishment of a Coop Unit in a forestry or biology department, which resulted in wildlife management beginning as a graduate program, and often staying that way for decades. Regional trends in natural resource program enrollment have been consistent, with peaks in all regions and majors in the mid-1990s, followed by a decrease to a lower level and then a leveling off, with wildlife enrollments perhaps increasing slightly in recent years to not far below their peak. In wildlife programs, no convergence of trends or cycles of enrollment was detected through time, particularly for the period 1980-present. Some schools were at record high enrollment in 2008 while others were near historic lows. One theme was a decrease in ratio of men to women in wildlife programs over the past several decades. Several schools reported that women outnumbered men in the undergraduate or graduate programs as early as the 1980s; that trend has continued at those schools, which tend to have male:female ratios near 1:1. Regional differences were identified, though, with some schools, particularly in the Midwest and South, reporting women at 35% or less of the undergraduate enrollment since the late 1980s.

Most programs have undergone a series of name changes that sought to portray how they viewed their content and missions. Changes have moved uniformly away from such names as Game Management or Wildlife Management to those such as Wildlife Conservation, Wildlife Ecology, and Natural Resources Conservation. To be sure, some schools have had such broad names for decades but even within those historically broader schools, the name of the wildlife concentration or degree has changed along the same continuum from an explicit management orientation to a less descriptive conservation or ecology title.

Our profession may have finally passed into the long-anticipated era in which incoming students must be assumed to have little experience with the physical tools of field work, very little background in the natural history of organisms, poor understanding of wildlife-habitat relationships, and scant exposure to consumptive or non-consumptive uses of wildlife (or their habitats). The shared perception among faculty is that many of the Millennial-generation students entering wildlife programs have acquired more pseudo-experience of nature via television programs and other media than direct experience via muddy boots and chore-calloused hands. Thus, university programs will need to work closely with potential employers of their graduates to design curricula and extracurricular activities to fill these knowledge gaps and still provide an education worthy of a four (or more) year university degree. Such activities will require some adjustment on the part of specialist faculty members and university administrators to develop more management-oriented courses for both game and nongame organisms, and to include more life history information in existing courses. Academic advisors will also need to stress to those students who intend to have a career in wildlife biology and management importance of acquiring knowledge and skills outside of the classroom to complement and better contextualize their class-based education.

#### **4 - Drivers of the Change**

University curricula are not static and evolve over time as educational institutions and individual programs adapt to internal and external factors. We identify internal and external

drivers behind curricula changes. Modal characteristics of students in colleges and universities are described and implications of these characteristics for education and the profession are explored.

University curricula typically change as a result of several interrelated factors, including institutional-level and program-specific factors. Institution-wide changes include an increase in number of credits reserved for general education or baccalaureate core requirements, and a subsequent reduction in number of credits available for classes specific to a degree program. National and international standards of education and changes in technology also affect curricula and training.

Professions evolve over time, which drives curricular modifications in response to specific training needs. In the wildlife field, increased emphasis on human dimension courses, additional courses in statistics, modeling and calculus and certification requirements have resulted in curricular changes at many universities. Learner outcome assessment is another process by which university curricula change. These changes may result in the addition of new courses or the deletion of courses, but more often result in a revision of how subjects are integrated throughout a curriculum.

Factors internal to a college or university also drive changes in curricula. Factors such as declining budgets, increasing cost of education and risk management all affect options for delivering curricula. Budget cuts have increased time demands on faculty with less time to teach hands-on curricula. The cost of education has increased substantially for students. The need to earn additional money to pay for their education limits the time students can spend focusing on classes and outdoor related activities. The increasing cost of education has also resulted in curricula changes that help insure that students can complete their degree in four years. Universities have also become more risk adverse, which may limit outdoor activities.

Students entering fish and wildlife programs also affect the type of education provided and the level of training our graduates enter the workforce with. Many students entering fish and wildlife programs today are from urban populations and have never been hunting or fishing. The result of these different backgrounds is that our current students enter our programs with few observational and field skills or direct knowledge of natural history. The current cohort of students entering colleges and universities has other characteristics that may challenge educators and have implications for the fish and wildlife professions.

## **5 - Theory vs. Practice**

To best prepare students for working in an increasingly complex world, students need to have a strong foundation in basic science and ecological theory, and universities need to ensure that training in applied skills is also included in curricula. Providing students with opportunities to appreciate and understand the North American Model of Wildlife Conservation, the role of wildlife and habitat management as an important part of the profession, understanding that there is more to conservation than wildlife research, and the political realities of managing wildlife populations seem to be critical needs. Students must be trained to be flexible enough to meet new challenges presented from changing and increasingly variable stakeholders and to understand that, for many agencies, some stakeholders (i.e., hunters) are customers. Students are responsible for choosing a program that fits them. Employers must be realistic about work-readiness of new graduates and work

with universities to help identify and develop skill sets needed in graduates. Universities should innovatively integrate broad-based topics within core curricula despite administrative demands for reduced credit hours. Universities also should allow as much flexibility in coursework as possible while providing instruction in essential skills in both theory and practice. Life-long learning is essential for professional growth and development and all entities should encourage use of continuing education to maintain and enhance the skills of wildlife professionals.

## **6 - Coursework vs. Experience-Based Learning**

Early in the history of humankind, all learning was by experience. Later, humans surviving their experiences long enough to produce offspring began at some point to educate their children about survival. As societies became larger and more complex, teaching styles evolved, eventually becoming the classroom style that is so prevalent today—and there is little doubt that the classroom method works—much knowledge has been imparted to students within the structure of the classroom. However, classroom based learning goes only so far; many things must be experienced outside the classroom in order to be learned. In few disciplines is this more evident than in wildlife science, where much of what we study is by definition—wild—and outside.

In the past decade or so, more emphasis has been placed on experiential learning techniques, even as early as middle-school. Evidence of the effectiveness of experiential learning also exists for wildlife techniques classes. Examples of this include courses at the University of Missouri-Columbia and at Michigan State University where students are presented with telemetry projects and allowed to discover the best telemetry techniques by trial and error. Another tool for experiential learning is on-campus research. Texas A&M University has successfully incorporated on-campus research on squirrels and on scaled quail. In both these cases, projects are first introduced in the classroom prior to actual work in the field.

Moving from a discussion of how learning takes place, to the subject of what is taught in the first place, shows some developing themes. For example, until recently most undergraduate wildlife statistics courses were taught by math and statistics departments, with some problems resulting. These departments, while sound on the quantitative mechanics, often overlooked the nonmathematical elements of statistics such as planning and managing scientific studies, defining the scope of the problem, defining data-collection protocols and developing sampling schemes. In the quantitative sciences, as well as in techniques and research, a problem-solving approach was found to work best. This approach is also advocated by the Department of Fisheries and Wildlife, Michigan State University where a model has been produced on using problem solving to teach quantitative analysis skills. In this model, questions are posed early on, before formal statistics training, to help students understand the need for such training.

In an attempt to obtain an up-to-date look at state wildlife agency requirements and expectations for entry-level candidates for wildlife biologist positions, we conducted an informal email survey of the NWTf technical committee. This committee is composed of the biologists in each state wildlife agency who are responsible for wild turkey management in that state. The survey was very simple, with only three questions, but the results are very

informative, and we think provide a good picture of what state wildlife agencies are looking for in entry-level biologists.

From the 17 agencies that responded, 41% required an MS degree, and 59% required a BS as the minimum education for an entry-level applicant. If experience was required, it was generally 1 to 2 years, but in several states an MS or higher degree could be substituted for the experience requirement. Over 82% of the agency biologists stated that basic biology, population management and data analysis skills were important for their agency's jobs. The top answer in terms of 'people skills' was the ability to communicate effectively with the public.

**Conclusions:** Current research has shown the effectiveness of experiential learning in promoting interest and retention from grade school through university programs. However, many university programs are unable to take full advantage of available techniques due to the constraints of time and budgets. At the same time, state wildlife agencies are looking for applicants with both advanced degrees and on-the-job experience, and are complaining that qualified applicants are hard to find. Tools for experiential learning are in place, and some schools have taken advantage of the techniques. Others are seeing a trend away from experience-based learning within their programs and toward a combination of coursework and either summer or internship work experience.

## **7 - Desired Competencies and Perceived Proficiencies of Entry-Level Fisheries and Wildlife Professionals: A Survey of Employers and Educators**

It is important that curriculum development be based on an inventory of desired knowledge and competencies for students, and this section presents results of just such an inventory. An electronic survey administered through TWS HQ was used to assess the perceptions of TWS members of the importance of knowledge for success in entry-level positions in a range of areas of competency. The survey also asked TWS members in various sectors of the wildlife profession (state/provincial agencies, federal agencies, nongovernmental organizations (NGOs), the private sector and academia) for their perceptions of the proficiency of recent entry-level hires in their organizations relative to the same areas of competency.

Membership of TWS was selected for the sample population because TWS members encompass the entire spectrum of the wildlife profession and because they were readily accessible through the society's membership database.

Respondents who worked for government agencies, NGOs, Native American tribes, or private sector firms answered a different set of questions than respondents who worked for academic institutions. Elements of the TWS Certified Wildlife Biologist program provided the framework for the survey. Nonacademic respondents rated the importance to success in entry-level positions of 32 topics that could be addressed in individual or multiple courses across the five major areas of coursework required by TWS for certification. Nonacademic respondents also rated the proficiency of recent entry-level hires in each of the 32 topics. Academic respondents first identified whether 30 topics (the same list presented to nonacademic respondents except that fisheries and interacting with stakeholders were deleted) were required for their undergraduate curriculum, whether the courses were taught

in or outside of their department, or not taught. Academic respondents also were asked several questions related to trends in field-oriented courses in their program and the importance and proficiency of students at the MS and PhD levels in the 30 topic areas..

On January 5, 2009 staff members at TWS headquarters sent all TWS members with email addresses (N = 7,381) a personalized electronic invitation to participate in the survey. We received responses from 1,750 TWS members (418 state agency personnel, 342 federal agency personnel, 111 NGO personnel, 235 members from the private sector, 218 university personnel, 27 local government, and 8 Native Americans).

Respondents in all nonacademic sectors of the profession identified nontechnical aspects of the job as the most important areas of competency, i.e., oral and written communication, working in teams and interacting with stakeholders. Although nonacademic respondents tended to rate proficiency of recent entry-level hires highest in these areas of competency, their mean ratings of importance and proficiency differed more for nontechnical than technical areas of competency.

Nearly all universities emphasized importance of writing and speaking skills in their curricula. However, results of this survey suggest that despite that emphasis, students may not be leaving school with the desired levels of competency in communication skills. It is notable that oral communication did not appear in the top ten for importance for either MS (rank = 21<sup>st</sup>) or PhD students (23<sup>rd</sup>). One potential strategy for improving writing skills is to incorporate more write/rewrite assignments in university courses; however, this strategy is time-consuming and costly for faculty. We found that perceived proficiency in written and oral communication did not differ significantly for respondents who identified Bachelor's, Master's, or Ph.D. degrees as the level of education needed for entry-level hires. Given the amount of effort that faculty members put into reviewing theses and dissertations, this finding is particularly discouraging.

The perceived problem with written communication skills may be more related to the type of written communication that students learn versus what they need on the job. Most writing assignments in college, whether they are term papers or theses, focus on research. Many wildlife professionals, especially those who work for government agencies, spend more time writing environmental assessments or management plans than research publications or reports.

It is clear that there remains a breach between knowledge and skills employers deem most important and the importance assigned to these topic areas by faculty at academic institutions. For MS and PhD students, faculty are likely to emphasize courses that develop and enhance competencies in organismal biology/ecology, statistics, and field techniques; doing so will ensure successful research projects and publishable results. In contrast, communication, working in teams, and working with stakeholders are clearly skills highly valued by agencies, NGOs and the private sector.

Improving students' ability to interact with stakeholders or in team settings is more problematic for universities. Although many university courses incorporate team assignments and courses emphasizing human dimensions have been added to the certification requirements for both TWS and the American Fisheries Society, human dimensions is still an

underdeveloped area in the curriculum of many universities. In our experience, students seem to readily understand the need for stakeholder involvement in making decisions about wildlife conservation. However, they have a more difficult time understanding the pros and cons of alternative approaches to public involvement in decision-making. This suggests that although students should be exposed to human dimensions in college courses, the most effective way of improving ability to interact with stakeholders may be through on-the-job training and continuing education of wildlife professionals who have gained some real-world experience.

TWS certification requirements appear to be relatively unimportant to academics when designing a curriculum. When asked to what extent certification requirements influenced curriculum decisions, 215 university/college educators ranked this factor at a mean level of 3.5 on a 10-point scale of importance.

The overall picture that develops from the survey is that gaps remain between academic faculty and potential employers of graduates from wildlife programs. In particular, proficiency in oral and written communication, and in teamwork is still perceived to be less than desired. It seems reasonable and important for agencies and academic institutions to continue to work to bridge this gap, so that well-trained professionals are prepared to enter the workforce.

## **8 - Identification of ‘Customers’ and Customer Needs**

An important aspect related to university curricula and preparation of graduates for their careers in wildlife conservation is the view of the future employers on the competencies of these graduates, most commonly state/provincial and federal wildlife agencies and non-governmental conservation organizations (NGOs).

Various surveys have indicated importance of this issue to employers and have documented a gap between competencies required or desired by employers and preparation by recent college graduates. This is most true for the “softer”, non-technical skills such as oral and written communication, working in teams, and interacting with stakeholders. There is also a widespread perception among employers of recent wildlife graduates that their new hires often lack backgrounds and experience, or even familiarity, with hunting and trapping, increasingly come from urban backgrounds, and arrive at jobs without basic experience in the use of field equipment and practical field knowledge.

The needs of employers have become more varied, especially as a result of the emergence of NGOs as significant employers of professional wildlife staff. In addition, agency and organization duties are increasingly complex due to increased emphasis on collaboration, demands for government to be more transparent and responsive to all stakeholders, and system-based approaches towards management. In truth, it is impossible to define a single set of skills, knowledge, and training that agencies need in their professional wildlife managers, and no one person has all of these diverse skills. Rather, employers need to hire and develop employees with a range of skills and interests to ensure that these diverse needs can be met over time as these individuals develop through their careers.

Employers can help to address the gap in a number of ways. They can broaden recruitment efforts, review minimum education and experience requirements for new hires, participate in

university advisory councils and reviews of curricula, support university efforts to provide experiential learning opportunities, engage TWS in discussions related to certification to ensure it is relevant to the work of our organizations, support university graduate programs with projects relevant to the employer's work, and develop and fund internship programs to give students real world experiences. They can also support lifelong learning and further development of their employees through workforce planning processes to define the future work and employee skills and experiences needed to do that work, developing employee orientation programs and requiring employee development plans, providing mentoring opportunities, encouraging employee participation in leadership programs, implementing programs geared towards developing the skills and abilities needed at all levels in the organization, supporting employee participation in professional meetings and conferences, and providing financial support for employees interested in pursuing continuing education opportunities.

Dialogue and debate around the topic is a healthy and necessary way to encourage discussion and collaborative approaches between educators and employers in addressing this challenge together. We need to be linked at the hip...universities cannot define their programs without input from employers; and employers can not place unreasonable demands on universities and/or graduates from university programs.

In short, professional education does not end with graduation. Instead, graduation is only the beginning of the second phase of a long and continuous educational road.

## **9 - What Should the 'Ideal' Wildlife Program Look Like?**

You could query 20 wildlife faculty and professionals regarding what they believe would constitute the "ideal" wildlife curriculum to prepare today's students for the jobs that lie ahead, and you likely would receive 30 different answers. There is probably no single perfect program. The field of wildlife science, ecology and management is broad and encompasses a great diversity of disciplines, all of which are important; it would be difficult if not impossible to cover all these topic areas in a typical 4-year BS curriculum.

As the field of Wildlife Management has evolved and matured over the years, in some cases, the true entry-level degree for professional wildlife positions in some cases has become a Master's degree. However, many positions still are available for graduates with a BS degree, and while opportunities for advancement may not be as broad, many BS graduates have a fulfilling career in wildlife management.

While acknowledging that the entry degree is in most cases a Masters, ideas for what the components of the ideal BS curriculum might be are presented below. At the undergraduate level, we cannot expect students to master everything that a potential employer might require, thus we focus on core competencies that should prepare students for either employment or continuation to graduate study. There is great diversity among programs that offer BS degrees in Wildlife, and there is variability among departments in terms of faculty expertise. Accordingly, in addition to the core competencies identified, some potential options or concentration areas that might be considered to build upon the core, taking advantage of faculty strengths, are also suggested.

Based on using the Master's degree to represent "entry level", academic respondents as described in the previous section indicated that written communication, ecology, statistics, and field skills were the most important. There was substantial divergence between academics and employers in their rating of the importance of oral communication and working in teams, with academics rating these areas lower in importance.

### ***CORE COMPETENCIES OF THE IDEAL PROGRAM***

In general, the TWS certification requirements for coursework represent the core areas of competency that should be present in any high-quality wildlife program purporting to prepare individuals for a career in wildlife including:

***Biological Sciences*** –Students should have a strong grounding in basic biology, ecology, zoology, and other "ologies" such as mammalogy, ornithology, herpetology, and similar classes. Within Biology, students also should have competency in botany and understanding of taxonomic systems. Biology and ecology form the foundation upon which the wildlife profession is based and should be a dominant component of any wildlife curriculum.

***Physical Sciences***- As outlined by TWS, students should have coursework in at least two of chemistry, physics, geology, or soils.

***Quantitative Sciences***- All students must have an understanding of the basic quantitative aspects of wildlife science. This background should include calculus and statistics. As more sophisticated analytical approaches to data analysis, modeling, population estimation and management are developed, it is critical that students be able to keep up, and in some cases, students may desire to take more quantitative courses.

***Humanities***- Courses in areas such as economics, political science, and planning are useful (although many students may not initially agree) and should be a core component of any wildlife curriculum.

***Communication*** – Courses in composition, public speaking, journalism or technical writing can help meet this core area. It was notable that this is the area where employers consider new hires not to be as competent as desired. It would be worth the effort of agencies and faculty to coordinate their efforts to identify ways in which higher quality experiences could be developed that help to ensure students graduate with the necessary communication skills, or at least the foundation to build on to further develop these skills.

***Policy, Administration & Law*** – As students prepare to enter the work force, it is critical that they have exposure to and understanding of natural resource policy, and the issues that impact implementation of management in the "real world." Courses in environmental law, planning, policy or human dimensions can help meet this need.

### ***OTHER POSSIBLE CORE AREAS***

***Teamwork & Stakeholders*** - The survey clearly indicated a gap in the perceived importance of teamwork and working with stakeholders between employers and academics. It would be well worth considering development of courses in this area, or adaptation of existing courses in curricula that will provide teamwork experiences and stakeholder experiences to students.

***Field experience*** – Previous sections have identified how students now often suffer from "nature deficit disorder" and lack the outdoors experience that many of us take for granted. Thus, a core component of any wildlife curriculum should include as much field time as feasible for the students. Much can be accomplished in the lecture hall or indoor lab,

but field skills can only be developed in the field. Seasonal internships with wildlife agencies can be an effective way to gain this type of ‘hands-on’ knowledge.

**Critical thinking-** It often appears as though too many of our students simply don’t want to think! A core competency that should be present in any newly minted graduate is the ability to think critically. This could in part be accomplished by addition of, perhaps, philosophy or logic courses into the curriculum, but would best be integrated into existing courses in various ways by innovative and enthusiastic faculty. We should not be telling the students *what* to think, but we surely can do a better job in helping them learn *how* to think.

### ***BUILDING ON THE CORE***

The previously mentioned topic areas should be the core component of any wildlife program. These basic competencies can be usually acquired from various programmatic areas on campus, and the core wildlife classes could be taught by any competent wildlife faculty member. In most wildlife programs, the faculty are diverse and can represent a variety of specializations. Thus, there often are opportunities to build upon these strengths in various programs by developing options or concentration areas that provide the students additional instruction and training in areas that will build upon their core understanding. Some potential (but not exhaustive) options include:

**Geospatial analysis-** the use of GIS is prevalent in most field studies, and it will benefit nearly all students to have exposure to and an understanding of GIS and remote sensing. It could be reasonably argued that in today’s world, GIS should be one of the core competencies. Various courses or practical field experience in GIS, remote sensing, geography, mapping, and so on could compose this possible option.

**Quantitative science-** There is an increasing demand for wildlifers with strong quantitative skills. A quantitative science option for undergraduates could include courses in modeling, regression, experimental and survey design, programming, multivariate analyses and quantitative population ecology.

**Behavior -** In programs with faculty who are strong in the area of behavior, it might be reasonable to develop an option in animal behavior, which could include courses in behavior, psychology, evolution and supporting areas.

**Ecology/evolutionary biology-** For students who may not have a strong interest in management and conservation, an option in basic ecology/evolution might be suitable. Additional courses added to the core might include coursework in community ecology, plant and population ecology, and evolution.

**Conservation biology –** Many programs already call themselves conservation biology, or have the option within their curriculum. Such an option should focus on the application of ecological principles to the conservation of biological diversity. This likely would differ somewhat from wildlife management in that the focus would be on wild species that are rare or endangered, and would lack emphasis on areas such as harvest management.

### ***CONSTRAINTS AND CHALLENGES***

The majority of faculty members in wildlife programs no doubt desire to provide the best possible curriculum for their students, with the intent of preparing them for their future career, whatever it may be. However, there are several constraints and challenges to implementing the ideal curriculum that exist that may hinder these efforts. Some of these are (in no particular order of importance):

***Diminishing resources-*** The economy is tough right now, and most, if not all, colleges and universities are undergoing budget cuts. This means fewer resources available to carry out educational objectives. Field and lab-intensive courses are expensive, and it is becoming increasingly difficult to secure the resources necessary to provide high-quality experiences to the students. Much of the increased cost is passed on to the students in the form of fees or increased tuition.

***University/College Core Curriculum*** – Known by several names, the “core curriculum” has become prevalent at most universities and colleges. The result is that often up to 30-40 credits (out of 120-130 semester credits required for a typical BS) are dictated to departments. While some “core” areas such as science and communication can be covered by coursework in areas such as biology, chemistry, composition, etc., the net result is a loss of flexibility in offering needed wildlife courses when developing a curriculum.

***Research reigns*** - At most Research-1 universities, research drives the institution. While we can't discount the importance of research, the pressure to bring in grant dollars and focus on research can detract from the quality of the undergraduate education that is provided by a program. Seldom is the reward system designed to recognize and reward high-quality, innovative instruction to the same degree that productive research is rewarded. While many faculty are dedicated to the research and the teaching missions of their program, and excel at each, in many cases undergraduate students get somewhat short-changed in their education as a result of faculty emphasis on research, thus the opportunity to master the core course areas is diminished.

***Too much to know, too little time-*** The field of wildlife management/biology/ecology/science has changed substantially over the past several decades. There is much more for students to know, they often come into their undergraduate program less prepared than previous students, and there is precious little time to provide them everything they need (or we think they need) to know in a 4 years. Additionally, as budgets become tighter, some higher level administrators are pushing for shorter semesters (some universities now have 13 week semesters, compared to the traditional 15 week term) and fewer credits necessary to graduate. Faculty often feel that they are not able to fully prepare a student in 4 years to be gainfully employed, and it appears that many employers might agree. Hence, the Masters degree has become the de facto entry-level degree.

### ***SUMMARY***

By following TWS certification requirements for coursework, we believe that specific areas that should be present in any program purporting to prepare individuals for a career in wildlife should include biological, physical, and quantitative sciences, humanities, communications, and policy/administration/law. Additional possible core areas included teamwork and understanding stakeholders, field experience, and critical thinking. Some potential (but not exhaustive) options to build upon these core competencies include: geospatial analysis, additional quantitative skills, behavior, evolutionary ecology, and conservation biology. Constraints and challenges to such a program included diminishing resources, University/College required core curricula, overriding importance of research dollars at universities, and the simple inability to provide “everything” a student needs within a 4 year program.

## **10 - How Do We Encourage Institutions to Build the ‘Ideal’ Wildlife Program**

Although surveys of employers in the agency and academic sectors affirmed importance of core subject areas, employers also affirmed the high importance of communications, working in teams, and ability to interact with stakeholders. Across the board, employers report that new hires are well qualified in the science and technical fields, but have inadequate preparation in interpersonal relationships and communications to meet job demands. Do these results reveal an expectation that graduates will come already equipped with high levels of proficiency in these areas? No, this is likely not the case. Rather, there is an expectation that new hires will understand that effective communications, working in teams, and interacting with stakeholders are essential components of the wildlife profession. The disconnect is largely explained by an education model that remains focused on the transfer of knowledge (principles, methods, facts) in subject areas rather than the broader preparation of students for the employment opportunities awaiting them. A different model is required, that accomplishes the transfer of knowledge in ways that simultaneously develop awareness, experience, and at least some basic skills for meeting the actual demands of chosen career paths. The required model recognizes that more than one dimension of competence is necessary for successful entry into the profession.

Aspiring wildlife professionals should possess a basic level of confidence and skills to work safely and competently in field settings. Students who are not field worthy may be passed up for seasonal jobs, experience difficulty in completing field assignments, be poorly prepared for graduate research, and miss out on the joys of fieldwork. Hands-on training helps students gain a fuller understanding of what jobs are about, while providing valuable skills. As well, the enjoyment that most students derive from hands-on experiences is a motivating force in their studies.

Young wildlife professionals need to understand that wildlife problems, while appearing technical on the surface, are most often confounded by moral, political, cultural, and economic issues that cannot be ignored. And because people of diverse backgrounds and perspectives have a stake in most wildlife issues, they must be participants in the discussions and processes that lead to management decisions. Students must be made to understand these processes and afforded opportunities to experience them and build some skills through practice.

Employers have affirmed that wildlife education, in addition to developing core knowledge in the basic sciences and ecological theory, must be responsive and relevant to society’s needs. Most jobs in wildlife today require critical thinkers who can grasp the full scope of complex problems including the social dimensions; engage with professionals from diverse disciplines; work effectively in teams to develop and evaluate potential solutions and options; communicate the consequences of those options to decision makers and the public; and, remain adaptive to change. That is a large order, requiring a lifetime of learning and practice to reach high levels of proficiency. We cannot expect graduates to commence their career paths with a fully developed range of problem-solving abilities. But we must insist that they be reasonably informed about what will be expected of them, and challenged with opportunities to learn those lessons by personal engagement rather than by rote.

The remainder of this section offers suggestions for what universities can do to encourage development of the additional competencies, beyond disciplinary knowledge and skills, which prepare students for successful entry into the profession.

### ***Field Worthiness and Hands-on Training***

In the wildlife profession's early years, Aldo Leopold emphasized a connection to the land as essential for developing understanding of how nature works and responds to management activities. Today, professors and employers alike note that many students lack the outdoors orientation and skills of previous generations. This translates into various problems, from fear and discomfort in field situations, to safety issues, to lack of basic skills required in routine fieldwork. Declining field-worthiness is a real concern, and yet several barriers discourage its greater emphasis in university wildlife curricula.

Aspiring wildlife professionals should possess a basic level of confidence and skills to work safely and competently in field settings. Students who are not field worthy may be passed up for seasonal jobs, experience difficulty in completing field assignments, be poorly prepared for graduate research, and miss out on the joys of fieldwork. Hands-on training helps students gain a fuller understanding of what jobs are about, while providing valuable skills. As well, the enjoyment that most students derive from hands-on experiences is a motivating force in their studies.

#### ***Barriers:***

- Urban backgrounds and attitudes about wildlife influenced by nature programming rather than outdoor experience
- Student dissociation from consumptive wildlife uses and values
- Students lacking in basic natural history skills and field savvy
- High cost of field-based courses, compounded by logistical issues and faculty workloads
- Large class sizes, high student-to-instructor ratios
- More credits taken up by university core and liberal arts requirements
- Liability concerns, compounded by administrators' aversion to risk
- Increasingly stringent animal care requirements that make hands-on learning less feasible
- Student reluctance to pursue outside assignments that "conflict" with other demands

#### ***Solutions:***

- Make basic field skills a core competency in the wildlife curriculum, preferably a first-year requirement so students will be field-worthy to commence summer jobs and other experience-building opportunities.
- Convince administrators that institutionalizing basic field skills in the core curriculum will reduce risk by inculcating a culture of safety, and reduce liability by demonstrating due diligence.
- Seek efficient ways to overcome animal-care barriers to hands-on learning (e.g., regularly-offered short courses for students to acquire certifications).
- Engage employers in advisory committees or other forms of partnership to guide and advocate for experiential learning.
- Enlist graduate students to develop and deliver hands-on instruction.

- Provide opportunities for students to “shadow” working professionals and assist graduate students in their research work.
- Enlist the help of retirees, affiliate faculty, and professionals in the public and private sectors to provide hands-on experiences.
- Increase field trip offerings, drawing upon others (see preceding point) to organize and sponsor them.
- Enlist paid or volunteer graduate students to deliver “mini courses” in high demand; for example GPS, radio telemetry, track and scat identification.
- Integrate campus-based research projects into the wildlife curriculum.
- Revise curriculum to include field oriented management courses collaborating with wildlife agencies for on-site classes at management areas, refuges, and private lands focusing on ongoing management, problems, and solutions.
- Offer orientation sessions for incoming freshmen and transfer students; take them to refuges, management areas, national forests, and other places to interact with wildlife professionals in field settings.
- Encourage students to participate in outdoor programs, orienteering classes, first aid training, hunter safety courses, and other individual pursuits to build confidence and skills for outdoor activities.
- Require participation in a summer field course or spring break fieldtrips with emphasis on field skills and hands-on activities.
- Build field-oriented internship requirements or opportunities into the curriculum.
- Encourage participation in student clubs. If a Wildlife Society student chapter is present, assign and reward a supportive advisor and facilitate a range of experience-building activities.
- Encourage participation with TWS at the parent and subunit level. Often subunits provide professional development workshops where students can provide assistance during the workshops to gain hands on experience as well as networking and mentoring opportunities with professionals.

### ***Communications, Interacting with Stakeholders***

For years “people skills” have been cited as a weakness in young professionals, leading many schools to add relevant coursework to the curriculum. In some cases the requirement is packaged as survey or specialized courses in human dimensions of wildlife management. In others, students are allowed to select from a list of subjects considered to be in the human dimensions realm. However, exposure to these subjects has not achieved the level of competence in communications and interpersonal skills that are needed to engage effectively with people within and outside the employing agency or organization.

Young wildlife professionals need to understand that wildlife problems, while appearing technical on the surface, are most often confounded by moral, political, cultural, and economic issues that cannot be ignored. And because people of diverse backgrounds and perspectives have a stake in most wildlife issues, they must be participants in the discussions and processes that lead to management decisions. Students must be made to understand these processes and afforded opportunities to experience them and build some skills through practice.

### ***Barriers:***

- Full curricula with no room to expand in human dimensions
- Continued domination of curricula by science and technical courses
- Downward trend in the writing abilities of entering students
- Faculty reluctance to accept human dimensions in the “mainstream” of wildlife education
- A generation of students intolerant of people who lack technological sophistication
- Dissociation or negative attitudes toward consumptive uses and users of wildlife

***Solutions:***

- Include learning about the North American Model of Wildlife Conservation in the curriculum so students will better understand, appreciate, and communicate the contributions of hunters in historical and contemporary wildlife conservation.
- Invite panels of professionals into introductory courses to inform students about career options and job realities.
- Incorporate wildlife case studies across the curriculum to demonstrate and reinforce the relevance of human dimensions.
- Identify written and oral communications as educational outcomes to be achieved through the concepts and methods of “teaching across the curriculum.”<sup>1</sup>
- Written assignments should include a variety of formats (e.g., briefing papers, media releases, public testimony, regulations), not just technical papers.
- Speaking assignments should target a variety of audiences.
- Encourage or require attendance at public meetings involving wildlife-related issues.
- Repackage human dimensions requirements into integrated course offerings with an emphasis on applications in the wildlife profession.

***Interdisciplinary Problem-Solving, Working in Teams***

Employers have affirmed that wildlife education, in addition to developing core knowledge in the basic sciences and ecological theory, must be responsive and relevant to society’s needs. Most jobs in wildlife today require critical thinkers who can grasp the full scope of complex problems including the social dimensions; engage with professionals from diverse disciplines; work effectively in teams to develop and evaluate potential solutions and options; communicate the consequences of those options to decision makers and the public; and, remain adaptive to change. That is a large order, requiring a lifetime of learning and practice to reach high levels of proficiency.

We cannot expect graduates to commence their career paths with a fully developed range of problem-solving abilities. But we must insist that they be reasonably informed about what will be expected of them, and challenged with opportunities to learn those lessons by personal engagement rather than by rote.

***Barriers:***

- Lack of clarity on students’ post-graduation goals and what that implies for required competencies
- Departmental and program boundaries that discourage integration

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<sup>1</sup> This approach strives to integrate skills and knowledge from peripheral fields (e.g. communications) into the courses of the main field (wildlife, natural resources management), thus reducing the number of courses overall.

- Reward systems driven by research and lacking in faculty incentives for innovative teaching
- Faculty stuck in the lectures-readings-exam model of instruction
- Students stuck in the lectures-readings-exam model of learning
- Insufficient emphasis on critical thinking
- Faculty inertia or resistance for changing the curriculum
- Perception that experiential learning requires substantial extra effort
- Lack of faculty with sufficient non-academic breadth to serve as role models and champions for experiential learning
- Large class sizes, low instructor-to-student ratios
- Student perception of a degree as an educational end-point, rather than a starting point for lifelong learning

***Solutions:***

- Take serious steps to understand students' short and longer-term goals; use results to define competencies and educational outcomes as drivers for the curriculum.
- Work with other departments or programs toward a common philosophy for integrating the educational mission across disciplinary boundaries.
- Creatively integrate real-world issues and problem-solving exercises into the fabric of the core curriculum. (i.e., modify course delivery methods rather than adding new classes).
- Integrate critical thinking exercises across the curriculum.
- Establish a series of integrated core courses that engage wildlife students with other relevant majors. For example:
  - Year 1: Introduction to Natural Resource Issues and Careers; Basic Field Skills.
  - Year 2: Introduction to Integrated Resources Management.
  - Year 3: Current Issues in Natural Resources Management (based on case studies).
  - Year 4: Capstone Course in Natural Resources Planning.
- Base capstone courses on actual problems that require integration across disciplines, working in teams, and interactions with stakeholders.
- Involve local professionals and stakeholders in designing and executing capstone courses.
- Establish a program advisory committee of professionals from key agencies and organizations; charge them with helping to make the curriculum more relevant and outcome-based.
- Enlist the advisory group to identify case studies and real-world projects for use in the curriculum.
- Encourage faculty to broaden into other (non-academic) sectors of the wildlife profession by pursuing sabbaticals and exchanges, for example through the Inter-governmental Personnel Act of 1970<sup>2</sup>.
- Encourage or require student exposure to locally relevant citizen forums (e.g., public hearings, roundtables, working groups, watershed councils).

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<sup>2</sup> This Act authorizes the temporary exchange of employees between US federal agencies and state or local governments including institutions of higher education.

- Emphasize lifelong learning as an essential element for career success; reinforce this message throughout the curriculum.

## **11 - Synthesis of Special Session of the 74<sup>th</sup> North American Wildlife and Natural Resources Conference: The Coursework of Conservation – Are University Curricula on Target?**

Effectiveness of wildlife professionals in the twenty-first century will depend on their skill at integrating an array of information from biological and human dimensions of wildlife management into sustainable decisions. The concern for linking university curricula and preparation for practice in the profession is evidenced by multiple special sessions at the North American Wildlife and Natural Resources Conference over the years that have addressed the issue, as well as discussion in other professional venues. Although the recurring emphasis on university curricula demonstrates importance of the topic to our profession, we believe the current focus is too narrow. Although universities play important roles in developing young wildlife professionals, so too, do employers and professional societies (e.g., The Wildlife Society and the American Fisheries Society). The question might be more productively phrased as, “Is the wildlife profession doing all that it can to thoroughly prepare wildlife professionals for their jobs?”

Professional societies, universities and employers share responsibility for three aspects of developing wildlife professionals. First, we must clearly define what it means to be a wildlife professional. Professional societies should have the lead role in defining the standards of professionalism. Second, universities should design their wildlife curricula to ensure that graduates meet the standards defined by professional societies. Third, employers should commit to supporting continuing education of their employees (and wildlife professionals should commit to life-long learning).

### ***Setting the Standards of Professionalism***

We all face a daunting task in defining the complex and moving target of professionalism. The expectations of competency for wildlife professionals in 2009 probably won't be adequate to meet demands of wildlife professionals in 2019. Furthermore, the complexity of the profession demands a wide array of competencies. For example, a natural resource agency needs field managers who are field savvy and know how to manage the land and its resources. The agency also needs research biologists who can design research projects that will produce credible science, program managers who can lead complex programs and work effectively with a variety of stakeholders to resolve controversies, and agency managers and leaders who can supervise employees effectively, think strategically, and manage budgets. All of these various types of wildlife professionals need different sets of communication skills to succeed in their jobs.

How important is TWS certification in determining university curricula? Overall, it appears not to have a strong influence (3.5 on a 10-point importance scale), but land-grant universities, the traditional source of education for several generations of wildlife professionals, attached more importance to certification than other state or private universities. That does not mean that only land grant universities produce students qualified to be wildlife professionals, as students graduating from other institutions may prove to be outstanding wildlife professionals. Nevertheless, comprehensive wildlife programs that

expose students to a variety of courses that address the currently expected competencies for wildlife professionals, such as those found at most land grant universities, may be the best place for employers to begin looking for future wildlife professionals.

To be relevant, certification criteria must be updated regularly. The current criteria for certification by TWS probably do not adequately reflect the need to integrate ecology and human dimensions. Despite the increased emphasis placed on human dimensions during the last revision of TWS certification criteria, the current criteria do not clearly define the need for a wildlife professional to understand that today's stakeholders demand, and are entitled to, a meaningful role in making management decisions. Although it is not likely to be explicitly stated as a criterion for certification, one of the real challenges of integrating human dimensions into wildlife conservation is dispelling the commonly held misunderstanding that increasing public involvement in decision making must result in diminished importance of biology in decision making. Another competency that is rapidly becoming a necessity in wildlife is knowledge of and ability to use geographic information systems (GIS). Courses focusing on GIS are not currently required for TWS certification (and in fact, are specifically excluded from consideration among quantitative courses).

### ***Design of Wildlife Curricula***

Universities walk a fine line between meeting demands of employers for young professionals, knowledgeable in biological and human dimensions of wildlife management, while maintaining a solid foundation of basic sciences and mathematics. All employers want the young professionals they hire to be field savvy, to have excellent communication skills, and to have the ability to work in teams and with stakeholders effectively. Nonetheless, few if any employers have a diminished expectation that their new hires will have a solid foundation in the sciences and math. If today's students have less exposure to the outdoors as youth, universities may have to begin teaching field skills that once were assumed of entering students. Some universities have already begun to do this. Is it realistic, however, to expect young professionals with bachelor's degrees (and probably advanced degrees) to display great competency in ecological theory, field techniques, communication skills, working effectively in teams and with stakeholders based on their formal education alone? For example, students who lack real-world experience engaging stakeholders may gain a basic understanding of appropriate roles of stakeholders and professionals in the decision-making process, but they are less likely to appreciate the finer points of how and when to use specific techniques of public involvement.

University faculty should collaborate with employers to define learning outcomes at all degree levels that will lead to development of desired competencies of wildlife professionals. Many university programs already have advisory committees comprised of representatives of the various sectors of the wildlife profession that could collaborate in curriculum discussions. Others have collaborative programs with faculty or graduate students sponsored by agencies. These discussions also should identify the knowledge and skills that should be the focus of formal education and which skills would be better learned in continuing education once young professionals have matriculated to the workforce.

Just as professional societies need to regularly re-evaluate their certification programs, universities need to regularly re-evaluate their curricula. This should be done in collaboration with their employer partners. Comprehensive wildlife programs must offer a variety of

courses that teach students the value of traditional wildlife management and conservation biology. The complex, interdisciplinary nature of resource management today requires broad thinking, not the narrow thinking promoted by a profession divided into wildlife managers and conservation biologists.

### ***Supporting Life-long Learning***

The most important message that employers should take from this report is that they should not expect entry-level hires to be finished products. Although students should have a life-long commitment to learning and professional development, employers must be committed to encouraging life-long learning and supporting professional development of their employees. Employer support for professional development may include support of employees in professional society meetings and committees and also support for continuing education workshops. Professional societies and universities should collaborate with employers to ensure that appropriate continuing education opportunities are provided for employees.

Employers might improve the chances universities will attend to needs of agencies by heeding advice of Scalet to “follow the money,” i.e., to provide funding for practical research of value to management agencies. Most university faculty members must support their research through external grants. If management agencies do not provide funding to support graduate students, faculty members will look elsewhere for financial support. The end result is that lack of funding from management agencies causes universities to conduct research that may be of less direct value to agencies. If the pattern persists, universities are less likely to hire new faculty members whose research focus depends upon funding from management agencies. Those faculty members are less likely to produce students who look to management agencies as their first choice of careers.

### ***Conclusion***

This special session of the North American, as did many symposia in previous years, addressed the question, “Are university curricula on target?” We conclude that while universities need to increase their focus on improving their graduates’ communication skills, ability to work in teams and to work with stakeholders, a deeper issue exists. The entire wildlife profession must be involved in preparing future wildlife professionals for the complex, interdisciplinary, ecosystem-based jobs in wildlife conservation. Professional societies should re-evaluate and regularly update their certification programs to ensure that they define the competencies needed to be an effective wildlife professional. Universities that wish to provide comprehensive wildlife programs should ensure that their students can meet certification requirements. A comprehensive wildlife program should provide a solid foundation in science, math and wildlife conservation courses and also ensure that students are field-savvy and can communicate effectively. Employers must stay engaged in curriculum discussions with their partner universities and support research projects that provide the information they need while training students to be future employees. Employers must also recognize that entry-level employees are not finished products and support their continuing professional development. The ultimate responsibility for individual professional development, however, lies with the wildlife professional who must accept responsibility for his or her own professional development by continually seeking to improve knowledge and skills throughout his or her career.