

Undergraduate Education Goals

Department of Fisheries and Wildlife

Michigan State University

Preamble: The mission of the Department of Fisheries and Wildlife (FW) at Michigan State University (MSU) is to provide the education, research and outreach needed by society for the conservation and rehabilitation of fish and wildlife resources and their ecosystems. Our department seeks to educate students who, upon completion of their undergraduate degree, will be prepared to successfully enter a job market, obtain entry into graduate school and continue to contribute their perspectives, skills and talent to conservation and resource stewardship throughout their lives. Seven goals were developed to provide an operational framework for our Department's educational mission. These goals provide the foundational structure for our undergraduate curriculum.

Strategies: In developing the curriculum, we have observed a number of areas that pose challenges, such as diversity among students in terms of areas of emphasis, professional goals, educational background, and learning styles. We have used the following set of strategies to aid in addressing these challenges. Note, however, that some challenges lead to strategies that require compromise. In other words, trade-offs must be made among strategies that are not entirely compatible.

- 1) We will utilize MSU and the College of Agriculture and Natural Resources (CANR) requirements to the extent possible to provide a base for our curriculum. We recognize, however, that these general requirements may not be sufficient for all areas (e.g., math, writing).
- 2) One goal of our program and the University is to produce students that are global thinkers and who recognize the need to be lifelong learners. This can be achieved, to some extent, via University requirements, but may need to be further emphasized in our departmental courses.
- 3) Because students have a diversity of career and professional goals, our curriculum should afford flexibility in areas of emphasis (e.g., wildlife, fisheries, genetics) and serve equally well those intending to go to graduate school and those seeking immediate employment. As part of our overall curricular strategy, we recognize that free electives are useful in developing students' individual goals and objectives. We also recognize, however, that too many free electives can potentially fail to encourage course choices that are sufficiently rigorous to prepare students for the workplace or graduate school.
- 4) Related to the above strategy, we further recognize that educational outcomes associated with our goals may be achieved through different courses. Thus, where possible we will include choices in course selection to achieve these outcomes.
- 5) Because the variety of learning styles among students is served best by differing pedagogical techniques (e.g., lecture, laboratory, experiential, problem-based learning), our curriculum should incorporate and encourage courses including a range of these techniques.
- 6) Although natural resource management is grounded in the scientific process, students require an appreciation of the limits of science-based knowledge, and the need to incorporate legal, social, political, cultural, and economic considerations. Thus, we will require students to take coursework in some of these areas, but importantly, we will take it upon ourselves to teach how these components interact within our management courses.
- 7) For students to develop mastery in any particular skill, knowledge or affective area, they require repeated exposure and exercise, with increasing rigor. Thus, the curriculum should be developed to include courses that reinforce essential elements throughout.
- 8) To maintain a collective identity among our FW majors, it is important to include some FW courses each year of the curriculum.
- 9) Transfer students pose particular challenges because they enter the curriculum at a different point than "traditional" students, and because they also hope to graduate in a timely fashion. We will develop our plans to maximize the extent to which the above strategies can be

implemented during the truncated experience of a transfer student, without unduly delaying the graduation of transfer students.

Goal 1: Students will be able to apply knowledge of complex socio-ecological systems to develop, implement, and evaluate natural resource management strategies.

Rationale: Students need to understand how natural resources are imbedded within a complex and interactive physical, biological and social environment, and how these components can be manipulated via management to achieve societal goals. In this context, management should be broadly viewed to include direct manipulations of animal populations, their habitats and human behavior, values and efforts aimed at engaging people about natural resource systems. Although not all of our students will become natural resource managers, they should all have the ability to develop natural resource management strategies following a logical, science-based management process. Thus, if their career path takes them into research, they will have an appreciation for how research supports and enhances natural resource management. Likewise, if their career path takes them into community service, NGO involvement, or non-fisheries and wildlife careers, these students will possess the desire to view natural resource management issues critically and to be involved in activities that effectively address these complexities.

Portions of this goal overlap with goals of allied fields such as zoology and botany that serve as foundational sciences. One of the key differences is that effective resource management requires an understanding of the natural environment, and the legal, social, political, and economic dimensions of ecosystems.

Outcomes:

- 1) Our graduates must achieve appropriate **cognitive levels** regarding the following:
 - a) KU¹: The major components of natural resource systems, including land/soils, water, people, aquatic and terrestrial organisms.
 - b) AA: The ecology of natural resource systems (i.e., interactions among these major components) at the population, community and ecosystem levels.
 - c) AA: The life history and biological requirements of one or more major taxonomic groups (e.g., fishes, birds, mammals, invertebrates) as they pertain to management.
 - d) AA: The human dimensions of natural resource systems including an ability to enhance their own analysis of any natural resource issue by placing it in the context of broader principles of human conflict and moral dilemmas, knowledge of basic psychological and sociological principles, and knowledge of natural resource organization structure and function.
 - e) AA: The complexity of natural resource systems, and an understanding of how to deal with complex systems (systems thinking).
 - f) SE: The logical, scientifically-based management process.

¹ Level of competence, from Bloom et al. 1956

- KU = knowledge and understanding;
 - Knowledge = recall of data
 - Understanding = understand the meaning, translation, interpolation, and interpretation of instructions and problems, state a problem in one's own words
- AA = application and analysis
 - Application = use a concept in a new situation or unprompted use of an abstraction; applies what was learned in the classroom into novel situations in the workplace
 - Analysis = separates material or concepts into component parts so that its organizational structure may be understood; distinguishes between facts and inferences
- SE = synthesis and evaluation
 - Synthesis = builds a structure or pattern from diverse elements; put parts together to form a whole, with emphasis on creating a new meaning or structure
 - Evaluation = make judgments about the value of ideas or materials

- 2) Our graduates must have an adequate mastery of the following **skills**:
 - a) Ability to develop a professional-level natural resource management strategy, proposal or plan.
 - b) Ability to design basic statistically-oriented evaluation or appropriate qualitative approaches of management plans or actions.
 - c) Ability to work with individuals within their organization and in other organizations to develop, implement, and evaluate management or research strategies.
 - d) Ability to conceptually model/analyze information about complex systems.
- 3) We prefer that our graduates have the following **affective** orientation:
 - a) There is an important role of political and policy processes which must be integrated with the logical scientific basis of successful resource management.
 - b) Successful management takes into account the complexity of the dynamics and interrelations among people, populations, and habitats.
 - c) Management of natural resources often depends on managing people.
 - d) Management should be evaluated to allow for appropriate adjustment to management actions.

Goal 2: Students will understand the range of social values and philosophies that can be applied to natural resource management and possess a professional perspective that recognizes and integrates this range of philosophies into a science-based approach to management.

Rationale: Our pluralistic society presents a complex of values and philosophies that can be applied to natural resource management at different levels; often these applications conflict. For example, animal welfare and rights philosophies that are applied to the organismal level often conflict with conservation and even preservation philosophies of population or ecosystem management. The strong traditional role of utilitarian values in the conservation philosophy of our professions often conflicts with preservation philosophy, even though the potential exists to effectively integrate them in many instances. Our students should understand conservationist and preservationist philosophies and be motivated to implement a balanced resource management approach when appropriate. They must be knowledgeable of animal welfare and animal rights philosophies and the difficulties in applying such philosophies to wildlife populations versus individual animals. Students should understand these and other philosophies and accommodate them where they do not interfere with the priority to manage ecological systems.

Outcomes:

- 1) Our graduates must achieve appropriate **cognitive levels** regarding the following:
 - a) KU: The meaning and distribution of a range of philosophies that have implications for natural resource management for scales ranging from local to global.
 - b) KU: The range of values that are applied to natural resources through a variety of wildlife-based recreation methods.
 - c) AA: The emergence and roles of a utilitarian-based conservation philosophy and preservation philosophy in American society as they relate to the fisheries and wildlife profession.
 - d) AA: The important differences in the nature of animal welfare and animal rights views and associated values, and the implications of each in fisheries and wildlife management issues.
 - e) AA: The ways in which the student's own natural resource values, use and management influence his/her natural resource management style.
 - f) SE: Their own philosophy of natural resource values, use and management.
- 2) Our graduates must have an adequate mastery of the following **skills**:
 - a) Ability to analyze natural resource issues and accurately identify the role played by key values and philosophies in those issues.
 - b) Ability to express and defend their philosophy of natural resource values, use and management.
 - c) Ability to find evidence of and track trends regarding the development of key values and philosophies in society that will have implications on their own resource management efforts.

- 3) We prefer that our graduates have the following **affective** orientation:
 - a) Students will understand and appreciate the full range of philosophies and values (e.g., utilitarian, preservationist, animal welfare, animal rights) and be motivated to implement a balanced natural resource management approach.
 - b) Students will understand and have an appreciation for nature-based recreation.

Goal 3: Students will have broad scientific knowledge from a variety of disciplines necessary to form the foundation for more advanced science-based courses.

Rationale: In addition to understanding the process of science and the limitations of this process, students require knowledge of scientific "facts" from a variety of disciplines to appreciate integrative aspects covered in more advanced courses. These "core" science classes are also important to provide students with a broad scientific training, allowing them to later pursue more focused areas within fishery and wildlife science.

Outcomes:

- 1) Our graduates must achieve appropriate **cognitive levels** regarding the following:
 - a) KU/AA: Molecular, cellular, and organismal biology.
 - b) KU/AA: Mathematics.
 - c) KU: Inorganic chemistry.
 - d) KU: Genetics or physiology or animal anatomy.
 - e) KU: Physics or organic chemistry.
 - f) KU: Earth science or geology or soil science.
- 2) Our graduates must have an adequate mastery of the following **skills**:
 - a) Basic laboratory techniques.
- 3) We prefer that our graduates have the following **affective** orientation:
 - a) The basic sciences are important foundations for understanding the complex ecosystem interactions between animals, plants, habitats, and humans.

Goal 4: Students will value science as a basis for problem solving in natural resource management, be able to apply scientific processes and knowledge to professional decision-making, and have a foundation to become an effective contributor to science-based resource knowledge.

Rationale: Ours is a science-based profession and our undergraduate program must adequately prepare students in the philosophy, findings and processes of science so that they possess the skills and attitude to successfully apply science to their natural resource-related career. Although someone entering the profession with a B.S. degree should be able to make limited contributions to scientific knowledge, a specialized career as a researcher in natural resources will require an advanced degree. Our curriculum, however, must provide students the foundations required for further development of research skills if desired.

Outcomes:

- 1) Our graduates must achieve appropriate **cognitive levels** regarding the following:
 - a) KU: The philosophical basis of science as well as its strengths and weaknesses as a decision-making tool.
 - b) KU: The historical and current status of the primary scientific basis for natural resource management in their field of interest.
 - c) KU: The appropriate integration of science with the political processes of natural resource management.
 - d) AA: The differences between science and other means of "knowing".

- 2) Our graduates must have an adequate mastery of the following **skills**:
 - a) Ability to apply scientific processes including hypothesis testing through experimental design, data management (collection, organization and analysis), interpretation (inferences, conclusions) and reporting.
 - b) Ability to effectively find, understand and apply existing scientific information relating to a resource management problem they are addressing.
 - c) Ability to apply logic, reasoning, and other associated critical thinking skills to effectively analyze natural resource problems.
- 3) We prefer that our graduates have the following **affective** orientation:
 - a) Value a scientific means of collecting information when science is a feasible and more appropriate basis for decision making than non-scientific sources of information.
 - b) Willingness to adopt and practice the ethics of science in their approach to resource management.

Goal 5: Students will be able to think quantitatively and apply quantitative tools to answer natural resource management and research questions.

Rationale: Research and management in fisheries and wildlife are highly quantitative endeavors. Effective management requires quantitative predictions about the dynamic responses of populations and ecosystems to natural and human-imposed drivers. Effective researchers and managers must think critically and quantitatively about natural resource problems.

Outcomes:

- 1) Our graduates must achieve appropriate **cognitive levels** regarding the following:
 - a) AA: Basic concepts of probability and statistics.
 - b) AA: Elementary mathematical representations of dynamic ecological systems within a management context.
- 2) Our graduates must have an adequate mastery of the following **skills**:
 - a) Students must be able to create and interpret quantitative representations of data.
 - b) Students must be fluent in the use at least one type of spreadsheet/graphing software.
 - c) Students must be able to apply basic statistical techniques to the analysis of data.
 - d) Students must be able to frame research/management problems in mathematical terms on an elementary level.
 - i) This outcome assumes that students are fluent in algebra, geometry and elementary calculus.

Goal 6: Students will be aware of a suite of field, laboratory, and computer-based techniques for studying and managing natural resource systems and will be able to use and apply those techniques appropriate to the student's specific career interests.

Rationale: An understanding of complex ecosystems and their management requires proficient use and integration of field, laboratory, and computer-associated techniques. The breadth of the fisheries and wildlife field precludes students from achieving even an introductory level mastery of all the techniques used by natural resource professionals. Students should be familiar with a diversity of techniques used in the fisheries and wildlife fields, and develop proficiency with a subset of those techniques appropriate to their individual interests and future professional plans. Proficiency should include not only an ability to implement these techniques and interpret their findings, but also the ability to identify assumptions, and potential biases or shortcomings associated with specific techniques and their application to particular natural resource management scenarios. Students should also develop attitudes and abilities conducive

to remaining current with emerging new techniques with application to novel resource management challenges.

Outcomes:

- 1) Our graduates must achieve appropriate **cognitive levels** regarding the following:
 - a) KU: The existence and purpose of a broad array of field, laboratory, and computer-based techniques generally used in the field of natural resource management.
 - b) AA: The existence, purpose, workings, and underlying assumptions of field, laboratory, and computer-based techniques specific to the student's natural resource career interests.
- 2) Our graduates must have an adequate mastery of the following **skills**:
 - a) Ability to select and use the appropriate field, laboratory, or computer-based technique for a given purpose, such as collection of field samples, observation of biota in the field or lab, processing of samples, analysis of data, and presentation of findings.
 - b) Ability to identify assumptions, and potential biases or shortcomings, associated with specific techniques and their application to particular natural resource management scenarios.
- 3) We prefer that our graduates have the following **affective** orientation:
 - a) Appreciation of the importance of field, laboratory, and computer-based techniques and an openness to evaluate and learn new tools as they are developed.
 - b) Dedication to the use of field, laboratory, and computer-based techniques appropriately, with respect for safety, animal welfare, and scientific ethics.

Goal 7: Students will be able to effectively communicate with a diversity of audiences.

Rationale: Effective, concise and appropriate communication skills (e.g., written and oral, verbal and non-verbal) are extremely important to the natural resource professional. Employers of our students continue to express the need for students to have more and better communication skills. Students majoring in fisheries and wildlife must be able to write effective letters, technical reports, plans, and publications for professional and lay audiences, and be able to convey their work orally to diverse audiences. They must be prepared as communicators who are effective listeners and sensitive to the use of body language. Additional interpersonal communication skills of value in today's society include the abilities of communicating inter-generationally and cross-culturally. Beyond the technical aspects of speaking and writing, students must have adequate skills in the principles of persuasion, facilitation, conflict management, and other useful communication tools.

- 1) Our graduates must achieve appropriate **cognitive levels** regarding the following:
 - a) AA: Principles of effective oral communication with emphasis on informing, persuasion and conflict management involving both professional and lay audiences.
 - b) AA: Principles and rules for written communication that are the basis for professional, effectively written products (e.g., grammatically correct, appropriately organized, efficient and well designed to achieve target goals with a variety of intended audiences).
 - c) KU: The role of non-language communication (listening, body language) in the process of effective communication.
 - d) KU: The rules for effectively using prevailing professional formats including email and other print and electronic media, correspondence, management plans and reports.
- 2) Our graduates must have an adequate mastery of the following **skills**:
 - a) Ability to write at a professional level demonstrated by an acceptable preparation of a management plan or technical paper, a "white paper" (issue analysis), and a popular article.
 - b) Ability to apply standard rules and procedures in the preparation of an electronic media message and professional correspondence.
 - c) Ability to design and deliver an appropriate communication strategy that achieves intended goals for an identified.

- d) Ability to communicate at an appropriate professional level in a variety of settings (e.g., media, interviews, legal testimony).
- 3) We prefer that our graduates have the following **affective** orientation:
 - a) Value the importance of effective communication in all forms with all intended audiences.
 - b) A positive attitude regarding their own current and potential ability to be effective communicators both in written and oral media.

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