

Designing an Interdisciplinary Management Plan as a Capstone Experience in a Conservation and Wildlife Management Class

• BRIAN F.M. OLECHNOWSKI



ABSTRACT

The academic fields of conservation biology and wildlife management have become highly interdisciplinary. The political, economic, sociological, and ethical dimensions within these fields must be studied and considered by students as conservationists put their management plans into practice. This paper presents a semester-long project for undergraduates in which they design a comprehensive interdisciplinary management plan that will enhance their understanding of conservation and wildlife management.

Key Words: conservation; wildlife management; interdisciplinary; student peer-review; writing practices; oral presentation skills.

The fields of conservation biology and wildlife management grew as a response to the rapid decline of the Earth's biodiversity (Chapin III et al., 2000). It is well known that these academic disciplines are considered "crisis sciences" (Pullin, 2002; Wilson, 2002). Decisions often have to be made quickly and effectively, sometimes with a lack of adequate scientific data.

Touval and Dietz (1994) argue that we must integrate interdisciplinary thinking when it comes to addressing the complex issues of conservation biology and wildlife management. It is important here to distinguish between the definitions of multidisciplinary and interdisciplinary approaches. Whereas multidisciplinary approaches involve several disciplines focused on one problem or issue, interdisciplinary approaches are an attempt to *fully integrate* the approaches of disciplines (Margles et al., 2010). Margles et al. state that an interdisciplinary approach to the central issues of conservation biology and wildlife management provides "a harmonious relationship" between various disciplines. These other fields include, but are not limited to, politics, economics, ethics, and sociology. We must also consider how

The fields of conservation biology and wildlife management grew as a response to the rapid decline of the Earth's biodiversity.

humans play a role in management actions. In addition, an effective conservation management plan includes critical thinking, effective communication, and exemplary writing skills.

Here I present an assignment in which students design an interdisciplinary capstone management plan that my conservation biology/wildlife management students work on throughout the semester. The project assumes prerequisite knowledge that students learn throughout the term and requires holistic thinking about conservation biology. Analytical skills, realistic goals, cooperation, a plan of implementation, and adaptive management are all required elements of the management plan. Jones (2003) states that all of these skills are necessary for effective conservation and management practices.

○ Layout of the Management Plan

There are four phases for the completion of the management plan project. Students are presented with the full expectations of the project within the first two to three weeks of the semester. Typically, in a group of 20 students, students will work in groups of four. I would recommend no less than three to a group because the project requires a great deal of work, and one of the project goals is cooperation among group members. The central goal of the project is to address a major conservation issue or problem relevant to any particular area of the world. The project scale may range from local to global. Students are asked to research extensively the conservation and/or the wildlife management issue that they choose, and then propose a plan (solution) that will maximize cooperation across the political, economic, ethical, and scientific stakeholders. Additionally, it will be important for the instructor to communicate to students that, while we are attempting to simulate a real-life scenario, sometimes asymmetric compromise between these

stakeholders is necessary (e.g., biologists may have to yield key tenets in a management plan in order for *any* positive results to come to fruition).

The first phase of the project is to develop a question and a proposal. Students are required to present this proposal to the class. The second phase of the project requires the students to hand in a full draft of their management plan to the instructor and a “review board” comprised of three to five students, which reviews the management plan; each is assigned a specific role related to the plan they are reviewing. Students on the review board then read the draft of the management plan and provide comments through the lens of their role. Project groups are then given back their plans for review. Rogers and Andres (2004) recommend that, at this point in the design of any student management plan, educators should only facilitate the learning process by guiding their students in identifying sources of information to conduct further research.

The third phase includes each project group presenting their final management plan to the assigned review board. At this point, the management plan should be in its final form, and the project team should have integrated suggestions made by the student board that peer reviewed their paper. After the conclusion of the presentation, the review board is required to ask questions based on the roles they are assigned. In the fourth phase of the plan, each board member is required to write a final short peer review of the project, which is handed in to the instructor. Management plans are then evaluated by the instructor, and students receive a final grade. I recommend this project account for 20–40 percent of the final grade for a conservation/wildlife management course. Individual assessment of each phase will be discussed. Students are also required to integrate knowledge they have gained in lecture and laboratory throughout the course of the semester in their plans.

○ Prerequisite Knowledge

My syllabus for conservation biology and wildlife management emphasizes interdisciplinary thinking. Students will need this basic background information to effectively complete their management plans. We do not follow the flow of information in any particular textbook. I do not utilize a typical lecture style because active learning strategies have proven to be more useful in educating students on the central themes of conservation biology and wildlife management (Nissenbaum & Gorke, 2001; Nissenbaum & Lewis, 2003). For example, classes include group work, addressing questions posed by the instructor that require critical thinking, and group quizzes.

During the course of the semester we cover topics such as the history of conservation biology, basic environmental law (e.g., Endangered Species Act and associated case studies), ethics (e.g., bioprospecting, intrinsic vs. extrinsic value of nature), politics (e.g., legislation related to global climate change), and basic themes of environmental economics. Many of these topics are presented to students before they design their initial management plan proposal. The major *biological* themes and concepts of conservation biology are presented throughout the semester as students work on their projects.

○ Phase I: Proposal Design

The first phase in the development of the management plan is for the students to develop a question and a proposal. Groups are

randomly assigned. They are given the guidelines of the proposal within the first two to three weeks of class, and present the proposal in the fifth or sixth week of class. Only an oral component is involved in this stage. The issue that the students choose to address should be specific and current. Three examples follow:

1. Should we manage Barred Owl (*Strix varia*) populations in the Pacific Northwest due to competition with the endangered Northern Spotted Owl (*Strix occidentalis caurina*)?
2. How can the United States move to a sustainable mixed-market energy economy to serve the needs of the population while preserving signature ecosystems and maximizing biodiversity?
3. Should Botswana open a sustainable trophy hunting industry to bolster their economy and serve the needs of their improvised citizenry?

Each proposal can be evaluated from multiple perspectives and must be a timely topic, one for which, to date, no clear answer yet exists. I suggest the proposal count for 20 percent of the assignment as a whole. I review the proposal out of 50 possible points and then multiply this grade by 0.2 toward the final grade for the overall project. The oral presentation is evaluated on the elements presented in Table 1, and should be approximately 15 minutes in length.

○ Phase II: Management Plan Draft and Peer-Review by Review Board

The second phase of the project requires students to hand in a full draft of their management plan. The management plan is given both to the instructor and an assigned review board. Students act as the review board for each plan and serve as peer-evaluators (approximately four students per plan based on the size of your class). The students are then given roles based on the directives and scope of the management plan that they are reviewing. The instructor is able to assign these roles after the initial proposal presentation that occurred weeks before. In Table 2, I provide two examples of proposed management plans and the assigned roles for the student peer-evaluators.

Note that every peer-evaluation team includes a conservation biologist. Each member of the board receives a copy of the full management plan draft. The students are then tasked with evaluating the management plan through the lens of the role that they are assigned. They are to provide ample comments on the paper to the management plan team. At this point, it is again important to note that the management plan is considered a draft. An instructor may choose to read the draft and provide students help with identifying additional sources of information for further research, as recommended by Rogers and Andres (2004). I do not recommend any further intervention by the instructor as students should feel confident about the direction of their project at this stage.

○ Phase III: Final Presentation to the Review Board and Finalized Management Plan

Phase III of this semester-long project culminates in each team presenting their finalized management plan to the student review

Table 1. The elements that should be included in the initial proposal of the management plan. Considerations for evaluation are also presented. The proposal is evaluated out of 50 possible points.

Element to be Evaluated	Points Allocated	Considerations for Grading
1. The question	5	Is the question being addressed realistic? Is it a modern topic in conservation biology and wildlife management?
2. Introduction	10	Have the students provided adequate background information to the issue? Have they integrated research and citations?
3. The stakes	5	Who does the management plan impact? Have the students moved beyond the realm of thinking strictly about biology (e.g., to considerations of the effects on people, the economy, and politics)?
4. Ethical issues	5	Have the students adequately addressed the ethical issues that are related to their proposed plan? Who may be impacted?
5. Species, Ecosystems	5	What species and ecosystems are impacted by the management plan? What ecosystem services are provided by these species and ecosystems? Are the species and/or ecosystems endangered (e.g., on the IUCN Red List)?
6. Initial management plan	15	What are the core pieces of the management plan? (An outline should be presented.) What initial suggestions are put forth to attain maximum cooperation among multiple stakeholders?
7. Research	5	Have the students cited at least 5 to 10 sources related to their initial ideas? Students should hand in a hard copy of their current citation list.

Table 2. Examples of student roles on a review board (peer-evaluators) that are assigned based on the directives and scope of the management plan they are reviewing.

Proposed Management Plan	Board Member #1	Board Member #2	Board Member #3	Board Member #4
How do we manage the feral cat population in the United States?	Conservation Biologist	A member of the People's Ethical Treatment of Animals (PETA)	An ornithologist	A bioethicist
Should we preserve the old growth forest of the Pacific Northwest for the sake of the Northern Spotted Owl?	Conservation Biologist	Logger who has lost his/her job due to the closure of timber industries	Congressman or Senator who is worried about job loss in his/her state	An economist studying the timber industry in the Pacific Northwest

board. By this point, the management plan should be in its final form, with peer-review comments incorporated, and turned in to the instructor for grading. I suggest that each team have 25 minutes to present their plan. The review board is then given 15 minutes to question each team (40 minutes total allotted to each presenting team). Each member of the board should have time to ask at least two to three questions based on the role they have been assigned. The quality and level of critical thinking of the board's questions is incorporated in the board member review grade for the project (see Phase IV). The quality of the presentation tends to reflect the quality of the final written management plan, and as a result both elements tend to be evaluated similarly. However, for the

presentation grade, I recommend points should be allocated for (1) presentation style, (2) clarity of Power Point slides (or any other mechanism by which the presentation may be delivered), and (3) the quality of the responses each management team has offered to the questions posed by the review board at the conclusion of the presentation. I suggest that the presentation account for a total of 20 percent of the project grade.

The final management plan that is evaluated by the instructor is the most important element of the project. The final plan should be approximately 10–15 pages in length and be a group effort among all members of the project team. At least 15–20 sources from the primary literature should be integrated into the

development of the final plan. Reliable Internet sources are allowed but do not count toward the 15–20 primary sources. It is not uncommon to see journals cited not only from the scientific literature but from literature in the social sciences, ethics, and even in theology/humanities as well. I recommend that the final written management plan account for 40 percent of the project grade. In Table 3, I provide a rubric for evaluating the plan. Note the extensions from the original proposal (Table 1). I review the plan out of 100 points (and then multiply this grade by 0.4).

○ Phase IV: Evaluation of Student Peer-Review (Evaluation by the Review Board)

The final phase of this project involves the evaluation of the quality of student peer-review (review board) based on their questions during the final presentations of the management plans. In addition, each peer-reviewer is also required to write a short written review (two to three pages) of the final presentation. This accounts for

Table 3. The elements that should be included in the final written management plan. The plan is evaluated out of 100 points. Considerations for evaluation and grading are presented.

Element for Evaluation	Points Allocated	Considerations for Grading
Question	2	Does the management plan have a clear title? Is the central question clear stated?
Introduction	10	Does the group provide an adequate introduction to the issues they are addressing? What are the major conservation and wildlife management issues involved? Have the stakeholders been identified; that is, who will the management plan affect?
Conservation Implications	20	What species and/or ecosystems will be impacted if we leave the situation in the “business as usual” scenario, that is, do nothing? How will humans be ultimately affected if we lose the species/ecosystems involved or if the system becomes severely degraded? Does the group address the role of the species in the ecosystem? Does the group address ecosystem services? Does the group address the extrinsic/intrinsic value of nature?
Central Management Plan	30	Is the plan broken down into subsections that can be easily followed, and does the flow of the plan make logical sense? Based on research, what are general solutions/methods of cooperation that address the conservation/wildlife management issue? How will the plan be executed? Who will be involved? What is the approximate cost of implementing the plan, and who will pay for implementing the plan? Does the plan involve and address the potential concerns of the relevant stakeholders (e.g., politicians, economists, blue-collar workers)? <i>*Additional Option:</i> Students may also include ideas for conservation outreach and how this outreach relates to the goals of their plan. Students should recommend methods to measure the success of these outreach programs (this can be considered part of the evaluation section).
Evaluation	20	How will the project group assess the progress and success of their proposed plan? What research and data will need to be collected? How will elements of adaptive management be utilized (Walters & Hilborn, 1978)? <i>Note:</i> Students are encouraged to consult “The Open Standards for the Practice of Conservation (http://cmp-openstandards.org) in their discussion of adaptive management. How would the group change the plan if your expected results do not come to fruition? (Each group should provide a theoretical example.)
General Conclusion	10	Has the group provided a concise synopsis of the above elements?
Literature Cited	8	Has the group presented at least 15–20 sources from the primary literature? Are the sources cited correctly (following the format of the journal <i>Conservation Biology</i>)?

the final 20 percent of the grade for this project (5 percent based on the questions the reviewers asked during the final presentation, and 15 percent based on their written review). In this written review, the student should include the name of the management plan they evaluated, the students who wrote and presented the management plan, and what their role was on the review board.

The students are asked to provide two major components to their final review. First, they are asked to analyze the management plan from an interdisciplinary perspective. They should address whether the team adequately addressed issues such as the economics of their plan (cost feasibility), if their plan could garner political support, if their plan was ethically sound, and how their plan would impact local communities. They are also encouraged to provide comments based on their specific role on the review board. Secondly, they are asked to analyze the plan strictly from the point of view of a conservation wildlife biology student. They should address whether the presenting team effectively utilized both empirical and theoretical information on the specific biological topics that were taught during the course of the semester (e.g., invasive species, meta-population dynamics, use of corridors, refuge design, adaptive management). The student evaluator is tasked with providing examples of specific theories and ideas that were addressed in the management plan. Note that this is a critical thinking exercise in peer-review. The comments made in the student peer-reviews do not impact how I, as the instructor, evaluate the final products of the project.

○ Conclusion

It is becoming increasingly impossible to practice the fields of conservation biology and wildlife management in a scientific vacuum. It is imperative that we include an interdisciplinary approach in our undergraduate courses (or any educational endeavor) in the biological sciences (Touval & Dietz, 1994). The project I have presented aims to accomplish this. I recommend that this project is presented in a step-wise fashion throughout the course of the semester, and that the final management plan serve as a capstone for the course. I would also contend that this project could be similarly utilized in an advanced high school environmental biology course. Such a project will enhance both the breadth and depth of your conservation/wildlife management courses, and students will have an increased appreciation for the direction that these disciplines are heading.

○ Acknowledgments

I would like to thank Drs. Diane Debinski and James Colbert for their pedagogical mentorship throughout my career thus far. I would also like to thank my colleagues in the Department of Biological and Allied Health Sciences at Fairleigh Dickinson University for their continued support. Finally, I would like to thank my students who have participated in this project and made it a success over the years.

References

- Chapin III, F. S., Zavaleta, V. T., Eviner, V. T., Naylor, R. L., Vitousek, P. M., Reynolds, H. L., Hooper, D. U., Sala, O. E., Hobbie, S. E., Mack, M. C., & Diaz, S. (2000). Consequences of changing biodiversity. *Nature*, *405*, 234–242.
- Jones, S. (2003). *Introduction to service-learning toolkit: Readings and resources for faculty*. Providence, RI: Campus Compact.
- Margles, S. W., Peterson, R. B., Ervin, J., & Kaplin, B. A. (2010). Conservation without borders: Communication and action across disciplinary boundaries for effective conservation. *Environmental Management*, *45*, 1–4.
- Nissenbaum, R. A., & Gorka, B. (2001). Community-based ecoeducation: Sound ecology and effective education. *Journal of Environmental Education*, *33*, 12–16.
- Nissenbaum, R. A., & Lewis, T. (2003). Ghettoization in conservation biology: How interdisciplinary is our teaching? *Conservation Biology*, *17*, 6–10.
- Open standards for the practice of conservation. (2016). [Online]. Available at <http://cmp-openstandards.org/>
- Pullin, A. S. (2002). *Conservation biology*. Cambridge, UK: Cambridge University Press.
- Rogers, A., & Andres, Y. M. (2004). Harnessing the power of the web: A tutorial for collaborative project-based learning. [Online]. Available at <http://www.gsn.org/web/>
- Touval, J. L., & Dietz, J. M. (1994). The problem of teaching conservation problem solving. *Conservation Biology*, *8*, 902–904.
- Walters, C. J., & Hilborn, R. (1978). Ecological optimization and adaptive management. *Annual Review of Ecology and Systematics*, *9*, 157–188.
- Wilson, E. O. (2002). *The future of life*. New York, NY: Knopf.

BRIAN F.M. OLECHNOWSKI is an Assistant Professor of Conservation Biology, Wildlife Management, and Animal Behavior in the Department of Biological and Allied Health Sciences at Fairleigh Dickinson University, 285 Madison Avenue, Madison, New Jersey 07940.