

A Case Study of the Program in Sustainable Development and Conservation Biology at the University of Maryland

The field of conservation biology (Soule 1985) and the Society for Conservation Biology are new enough that many of the scientists important in their conception are still alive and active in the field, and the business of training students explicitly in this field is even newer. A large number of the existing graduate programs began about the same time, around 1990, when many—including the University of Maryland's—were initiated in response to the funding initiative of the Pew Charitable Trust, "Integrated Approaches to Training in Conservation and Sustainable Development" (Jacobson 1990). In 1995, Jacobson et al. listed 51 graduate programs, and now about 75 are listed on the Web site (<http://conbio.net/scb/services/programs/>). But the growth of new graduate programs in conservation biology seems to have slowed down in the past several years (a qualitative impression based on announcements of new programs and changes in the list on the Web site), perhaps indicating that conservation education has reached some plateau and maybe even a carrying capacity. Another indicator of the youth of the field is that there has not yet been any ranking of graduate programs in conservation biology by a disciplinary organization such as the Society for Conservation Biology, a governmental panel such as the National Research Council, or even a private effort such as that of the magazine *U.S. News and World Report*.

Assuming that the programs for training graduate students to be-

come practitioners of this new field may have reached some equilibrium, it seems an opportune time to consider issues such as what kinds of students are applying to these programs, what kinds of students are being admitted to them, and where graduates of the programs are employed. Given the difficulties of surveying multiple programs at a variety of universities (Inouye tried), we address these issues from the perspective of a case study of the Sustainable Development and Conservation Biology program directed by Inouye, which may or may not be a "representative" program. However, as one of the approximately 30 programs designed in response to the Pew Charitable Trusts initiative in 1987, the program at the University of Maryland (UM) is probably similar to those on other campuses in that pool. The information reported here may be of interest to readers advising undergraduates about graduate work in conservation biology or to students considering careers in the field. For details about the variety of graduate programs available, please see the links available through the Society for Conservation Biology's Web site (<http://conbio.net/scb/>).

The University of Maryland Program

The graduate program in Sustainable Development and Conservation Biol-

ogy (adopted from the title of the Pew Charitable Trusts initiative) is a non-thesis, interdisciplinary M.S. program that seeks to train students who will become involved in the management of development or conservation programs. The curriculum was designed with the help of a panel of potential employers from conservation and development organizations in the Washington, D.C., area. Students are required to take 39 graduate credits, which they typically complete in four semesters. About 16 of these credits come from four required core courses: (ecology, resource economics, policy, and problem-solving: Touval & Dietz 1994; Cannon et al. 1996; Inouye & Dietz 2000). Remaining credits are completed in elective courses that students can use to develop their interests in resource economics, environmental policy, environmental education, ecology, or other areas. Students are also required to write a scholarly paper ("library thesis") and to complete an internship, typically during the summer and often in a nongovernmental organization or federal agency in or near Washington, D.C.. The program has no faculty of its own; the director and associate director are both faculty members in the Biology Department, and students take most of their courses from other departments. In addition, several adjunct faculty members from organizations around the Washington, D.C., area teach seminars, advise interns, and give lectures. Because this is a non-

thesis degree program, individual advisors are not required or assigned. The director and associate director of the program serve as advisors, and peer-advising among students is common. As of December 2002, there are 118 alumni of this program. (For more information about the program, see www.umd.edu/cons.)

The Applicant Pool

In the first year of the graduate program in Sustainable Development and Conservation Biology (1990), there were 6 applicants. Within a few years the number had increased 10-fold, and since 1995 the number has ranged from 61 to 72 each year (Table 1). The subset of international applicants has grown more slowly, but for the past few years has ranged from 10 to 15. Grade point average (GPA) and Graduate Record Exam statistics for the applicant pool are shown in Table 2. It is possible that there has been some self-selection in the applicant pool in response to the UM program home page, which includes statistics on the GRE and GPA of recently admitted applicants.

The percentage of women applying to the UM program has consistently been much higher than that of men, for reasons that are unclear to us. In the past 3 years the percentage of females applying has ranged from 58% to 79% (58% in 2002 was the closest to an equal gender ratio; this may have been an outlier because the ratio in 2003 was back to 72%). This bias does not apply universally to graduate applications at the UM campus, although the Biology Department graduate programs have received more applications from women than men over 2 of the past 3 years (62%, 63%, 50%). Most applicants to the Sustainable Development and Conservation Biology program are one or more years post-baccalaureate (Table 1, Fig. 1), with a range in the past 3 years of 0–23 years. Few applications are received

Table 1. Profile of applicants to the University of Maryland's Program in Sustainable Development and Conservation Biology.*

Year	U.S.A. applied/ admitted/ matriculated	International applied/ admitted/ matriculated	Women applied/ admitted/ matriculated (%)	Mean no. years since baccalaureate applied/admitted
2002	48/17/11	16/7/5	58/56/79	3.2/3.0
2001	63/27/12	10/4/0	79/77/77	2.7/4.5
2000	47/24/15	14/7/3	66/75/76	3.0/5.25

*Number, gender ratio, number of years since baccalaureate of applicant, students admitted, and students enrolling for the last 3 years. Applicants from the United States (U.S.A.) and from other countries (international) are reported separately.

from minority students, despite efforts at recruiting them. Applications from people with advanced degrees are not uncommon, including a lawyer, two veterinary doctors, and people with Ph.D.s in economics and psychology (all of whom were admitted). Two students have enrolled in the UM program while concurrently completing law degrees. Six of 43 current students enrolled already possessed masters' degrees in engineering administration, economics, environmental science, international training and education, neuroscience and behavior, or physics.

There seems to be a trend for increasing diversity in the undergraduate backgrounds of students applying to the UM program. Most of the applicants have had undergraduate majors in biology, but students also have been accepted with undergraduate degrees in accounting, anthropology or sociology, biological anthropology and anatomy, communication studies, comparative area studies, economics, environmental science, geography, history, individualized study,

international affairs, international relations, Latin American studies, political science, physics, political theory and constitutional democracy, public relations, social relations, and wildlife biology.

Admissions Process and Matriculating Pool

In addition to standard application materials (general GRE scores, two essays, three letters of recommendation), applications are screened for indications that a student is likely to be able to benefit from, as well as contribute to, the graduate program. For example, one indication is one or more years of post-baccalaureate experience (e.g., Peace Corps experience, work in a nongovernmental organization or in business). The admissions committee also looks for indications that a student is likely to become a leader in the field of conservation biology. The criteria for this are not quantitative but may be less nebulous than it might seem

Table 2. Mean GPA and GRE scores for applicants and admitted students (2002) for the Program in Sustainable Development and Conservation.

		GPA	Verbal	Quantitative	Analytical	Total
Applicants	United States	3.41	577	668	675	1920
	international	3.04*	472	587	564	1623
Admitted	United States	3.65	643	726	744	2113
	international	3.23*	452	608	527	1587

*The GPAs were only available for eight applicants, five of which were admitted.

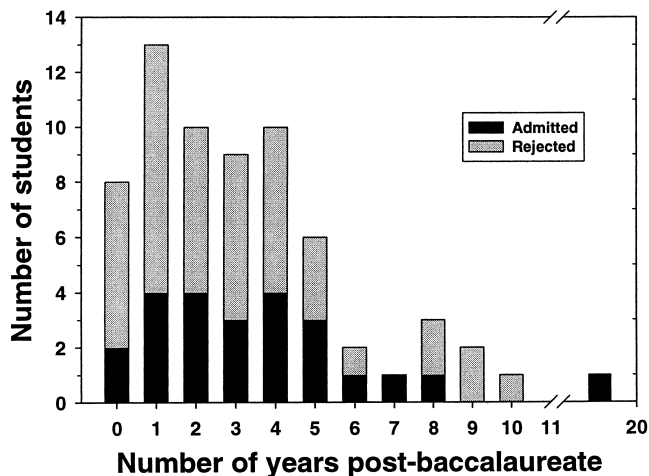


Figure 1. The distribution of post-baccalaureate years of experience for the 2002 cohort of applicants, subdivided into admitted and rejected applications.

(Dietz et al. 2004). They include evidence that candidates are intellectual role models, have strong interpersonal skills, have the courage to vocalize controversial ideas and opinions, can convey a passion for work and environmental interests, and are cited for the quality of their work. As is probably true at most universities, there is pressure from the higher administration to pay attention to GPA and GRE scores, but the Sustainable Development and Conservation Biology program has no absolute criteria for any of these quantitative measures.

Each year, the intention is to enroll about 15 new students, so the admissions target is to identify a few more than this number in case some of the students admitted decline to accept, which happens regularly. Each year, some admitted students are lost to what are considered competing programs (such as those at Duke and Yale), but more commonly applicants have been trying to decide between alternate career paths and wait to make that choice until after they see which graduate programs offer them admission. Each year a few of the applicants admitted end up going into Ph.D. programs instead, having decided they

are more interested in research careers. Last year, six of the students admitted to the Sustainable Development and Conservation Biology Program fell into this category, a larger number than usual. Other students move on to Ph.D. work after completing their M.S. degree in the UM program.

Although there are no absolute criteria for quantitative measures (e.g., the mean GRE scores of international applicants accepted last year were lower in some areas than those of the general international applicant pool, possibly reflecting language and/or test-format biases; Table 1), students admitted to the UM program tend to rank at the higher end on quantitative measures of performance such as GPA and GRE (Table 2). These rankings have been higher than those for other graduate programs (mostly Ph.D.) in the College of Life Sciences at UM and are among the highest for programs across the campus. The biased gender ratio that characterizes the applicant pool also carries over to the matriculating pool: for the past 3 years the gender ratio has been 76%, 77%, and 79% (Table 1). The average post-baccalaureate period for admitted students in 2002 was 3 years (range 0–19 years), indistin-

guishable from the mean for the applicant pool (range 0–19 years).

How Are Students Funding Their Education?

The Sustainable Development and Conservation Biology Program is fortunate to be able to offer financial support to almost all students who request it. A few students each year receive graduate school fellowship support (for their first year only). These fellowships are awarded through a campus-wide competition. Other students are employed as teaching assistants, primarily in undergraduate biology courses, or sometimes as graduate assistants for various programs on campus (e.g., advising undergraduates or working in the fellowship office). Teaching assistantships and graduate assistantships provide a 9-month stipend and 10 credits of tuition remission per semester in exchange for about 20 hours of work per week. The majority of students receive additional financial support associated with their internships. It is our impression from talking with students that many other conservation graduate programs are not able to provide financial support to such a large proportion of their students (particularly in larger programs).

Funding for international students is more problematic because they often do not meet minimum English language skills for a teaching assistantship, and their GPA or GRE scores may not be competitive for university fellowship support. Most international students in the Sustainable Development and Conservation Biology Program have come with outside fellowship support, through agencies such as LASPAU: Academic and Professional Programs for the Americas (www.laspaui.harvard.edu), Fulbright, or the Organization of American States, or with support from their governments. If other

sources of support for international students were available, it probably would be possible to increase the number of international students admitted to the program.

Graduates and Their Employment

The track record for employment by graduates of the Sustainable Development and Conservation Biology Program has been remarkably good. None of the students has reported difficulties finding jobs for the past decade. Many of their job opportunities have arisen through contacts made during internships or in the problem-solving course, during which students work as consultants for conservation-related clients in the Washington, D.C. area. Networking among the alumni and/or adjunct faculty from our program also has been productive. In the past few years, graduates have taken jobs at nongovernmental organizations such as Conservation International, The Nature Conservancy, World Wildlife Fund, American Bird Conservancy, National Geographic Society, and International Association of Fish and Wildlife Agencies, or in government agencies such as the U.S. Department of Agriculture's Natural Resources Conservation Service, the U.S. Geological Survey, the National Oceanic and Atmospheric Administration, the Organization of American States, and the Chesapeake Bay Critical Area Commission. A few have gone into education, teaching at high schools or universities (instructor level) and, in one case, as an interpretive exhibit manager for the National Zoological Park. The international students mostly have returned to their home countries to work either for private organizations or government agencies and to teach in university positions they held before entering the UM program. (Information about alumni and

their employment is available at www.umd.edu/cons/list.html.) It is not clear to what degree the job-placement success of UM graduates is related to the geographical proximity to Washington, D.C. and its conservation-related employers.

About 15% of graduates have gone into Ph.D. programs in biology, geography, public affairs, resource economics, and other environmental fields after completing the non-thesis M.S. degrees at UM. These graduates have reported that the breadth and depth of training they received in the Sustainable Development and Conservation Biology M.S. program served them well as they worked on more narrowly focused Ph.D. projects.

Conclusions and Call for Further Study

About the time many graduate programs in conservation biology were just getting off the ground, Jacobson (1990) pointed out that the development of graduate training in conservation biology as a cross-disciplinary field faced a variety of obstacles. These included the disciplinary structure of academia, barriers to communication among disciplines, and the lack of model curricula. Fortunately, most of those barriers now seem to have been overcome. For example, in the Sustainable Development and Conservation Biology Program, core courses are required in three different colleges, and the faculty in those areas are pleased to have the additional diversity that students in the program represent. A student-run group focusing on ecological economics draws participants from several different departments, and UM is about to implement a dual M.S. degree program in conservation biology and public policy.

Given that 60–70 students apply for about 15 slots in the program each year, it appears that there is a significant pool of students wishing

to (1) pursue careers in management of development or conservation programs after training at the M.S. level or (2) develop breadth in conservation biology before pursuing Ph.D. studies. It also appears that many of these students are of high caliber, at least matching the quality of students applying to Ph.D. programs in biology. These students are coming to the field of conservation biology with a wide range of undergraduate majors (albeit primarily related to biology) and with a diverse range of post-baccalaureate experiences. In some cases they are making significant career changes from unrelated fields, and in other cases they want to develop interests inspired during post-baccalaureate nonacademic experiences. It is possible that, because there are no prerequisites for most of the courses in this program (e.g., no requirement for chemistry, physics, cell or molecular biology, statistics, or calculus, although some of these are recommended), perceived barriers to making a career change are minimized.

It is not clear whether or not the female-biased gender ratio of UM applicants and matriculating students characterizes all graduate programs in conservation biology. This trend seems unusual because of the well-documented male-female disparity that has resulted in very male-biased populations in most mathematics and science programs and careers. Why are some of these students now reconsidering a science-based program of study at the M.S. level? Students at UM had some opinions to offer. For example, several students in the Sustainable Development and Conservation Biology Program suggested that women may pay less attention than men to the income-generating potential of different careers and that they may therefore have a greater tendency to pursue careers to which they feel a personal commitment or that will help solve environmental problems (i.e., value-driven decisions), even if such careers are

not likely to be lucrative. We have, in fact, occasionally heard such opinions expressed in applications from women. However, none of the students had done any research into what the potential salaries are for positions they might qualify for after graduating (a salary survey is now in progress). Seymour and Hewitt (1997) may shed light on why the field of conservation biology is attractive to women. Students in their study who left the sciences as undergraduates were looking for coursework and programs that emphasized understanding and application of concepts, thinking and figuring things out, discussion, and stimulating and relevant content. Perhaps the maturing field of conservation biology exemplifies these elements of relevance and engagement and thereby draws more women students and students from other underrepresented groups at the graduate level. This is a hypothesis worth further examination.

The fact that UM graduates have had great success in the job market and in pursuing Ph.D. studies indicates that there is not yet a surplus of students being trained in conservation biology at the M.S. level. Although the recent economic downturn, and one several years ago, resulted in significant declines in budgets at most conservation-related nongovernmental organizations, apparently there is still enough growth, or at least turnover, of jobs in that sector to provide many employment opportunities. Thus, graduate programs in conservation biology at the

M.S. level appear to be serving an important role of training students for these opportunities.

It is unclear to what degree the UM program is typical of others in the United States, but given the fact that it was one of those initiated in response to the Pew Charitable Trusts funding initiative, we expect a significant similarity with those other programs. Also, it is not clear to what degree the UM applicant pool reflects that of other programs, although we do know that many students who apply to this program also have applied to other programs on the east coast of North America such as those at Yale and Duke, as well as to other universities such as the University of Michigan and the University of Wisconsin. We have not done any follow-up work to find out how many of the applicants who were declined admission at UM enrolled in other conservation biology graduate programs. Perhaps the Society for Conservation Biology can be encouraged to take the lead in beginning to compile and track some of these statistics to provide insights at the national level. We encourage graduate directors to collect and share the kinds of statistics we have reported here so that a broader comparison of programs will be possible in the future.

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