

SELF-STUDY REPORT FOR THE PERMANENT STATUS PROGRAM REVIEW OF THE PH.D. PROGRAM IN THE DEPARTMENT OF ENTOMOLOGY AND WILDLIFE ECOLOGY

Submitted as Part of a Proposal for **Permanent Status of the Doctor of Philosophy in Entomology and Wildlife Ecology**

I. DESCRIPTION

The Department offers programs leading to the Master of Science (M.S.) in Entomology, M.S. in Wildlife Ecology, and the Doctorate of Philosophy (Ph.D.) in Entomology and Wildlife Ecology. Graduate students in these fields couple a focus on insects or vertebrates with a broad knowledge of other related fields of biology, especially ecology. The M.S. degree programs prepare students for pursuit of the Ph.D. and careers in entomology, wildlife ecology, and other biological disciplines. Students pursuing the Ph.D. degree program in Entomology and Wildlife Ecology have to satisfy the requirements in at least one of two concentrations, Entomology or Wildlife Ecology. The M.S. in Entomology, in place since 1949, was changed to M.S. in Entomology and Applied Ecology in 1999, then back to M.S. in Entomology in 2007. The M.S. in Wildlife Ecology was added in 2004 and is scheduled for review for permanent status in 2009. The Ph.D. degree program received provisional status effective September 1, 1999, and is scheduled to be placed before the University Senate for permanent status in the 2008-2009 academic year. The department modified its name in 2003, replacing “Applied” with “Wildlife” to accommodate the emphasis on wildlife in the curricula.

II. RATIONALE AND DEMAND

A. Institutional factors.

The Department of Entomology and Wildlife Ecology has as its mission “to conduct basic and applied research in entomological and wildlife conservation issues that addresses society’s problems, improves management practices that are compatible with environmental stewardship, and advances biological knowledge; to educate undergraduate and graduate students to become professionals and citizens capable of solving problems and disseminating information; and to assist the public in matters related to insects, wildlife and other forms of biodiversity” (Department of Entomology and Wildlife Ecology Mission and Goals, modified June 1997, and September 2007; originally developed by faculty in 1988 “Project Vision” document).

The department contributes primarily to Planned Program 3 of the State of Delaware Plan of Work for 2007-2011 (University of Delaware and Delaware State University), Ecosystems, and Biodiversity. Activity contributing to this program includes research and extension programs targeting (1) Integrated pest management; (2) Sustainable Agriculture/Forestry; (3) Wildlife, Woodlands, and Aquatic Resources; (4) Wetlands Ecosystems; (5) Protection of Delaware’s Native Species; (6) Master Gardener Training; (7) Human Activities and Natural Environment; and (8) Wildlife Management.

B. Student demand

We feel that our Ph.D. program has been successful in part because of its relation to our M.S. program. While it is possible for a Bachelor's graduate to go directly into the Ph.D. program, we prefer that students complete the M.S. degree before being admitted or reclassified into the doctoral degree program in Entomology and Wildlife Ecology. Consequently, we have a significant proportion of our graduate students in the Master's program. Approximately 40% of our Master's graduates go on for the Ph.D. either at Delaware or at another university. All of our admissions to the Ph.D. program except for those who already had a Master's degree have been admitted first to the Master's program. The proportion of students in the Ph.D. program is not as robust as it would be if we matriculated applicants wishing to obtain the doctorate directly into the Ph.D. program.

Because the Master's program is integral to our Ph.D. program, data for the M.S. is also presented in this self-study. The history of the number of applications, offers, and students admitted to our Master's program are presented in Table 1. Our graduate program continues to attract a suitable number of applicants. The new Ph.D. program seems to have improved the number and quality of applications overall. The number of applications steadily increased from 1999-2004. The decline noted in 2005 can be explained by our recruiting approach in the highly competitive field of wildlife ecology; when a funded assistantship becomes available, a nationwide search generates potential applicants who are screened by the advertising professor before they are given the go-ahead to apply on the university system. This practice reduces the number of times a potential graduate student has to apply and pay a fee to various programs around the country. In one case, Dr. Williams received 37 applicants regarding a black duck project, only one of whom actually applied for admission into our program. Consequently, the wildlife program receives many more "applications" than is apparent by information generated by the Office of Graduate Studies. The Graduate Record Examination scores for the Master's program are presented in Table 2.

Table 3 provides application and Graduate Record Examination data for our Ph.D. applicants. The average score for the total of the verbal and math for seven admitted students is 1260. By comparison, the long-term average for admitted students to the Master's programs is 1171 (Table 2).

C. Transferability

The department accepts very few transfers. Since initiation of the Ph.D. program, one student transferred from Michigan State University then subsequently transferred back to Michigan State as a doctoral student due to a life change event.

D. Demand and employment factors

The number of foreign applicants as well as foreign students admitted has gone down since 1997. All of our admissions to the graduate programs in our department have been from domestic applicants over the past 10 years. While we view the fact that our graduate programs have been attractive to domestic applicants as a positive indicator of excellence in graduate studies, we feel we should increase opportunities for admitting a few foreign students for each program cycle.

E. Regional, state, and national factors

Among entomology departments, ones that historically have been similar to ours are the Department of Entomology at Rutgers University in New Jersey, and the Department of Plant, Soil, and Insect Sciences at the University of Massachusetts at Amherst. These comparisons are weak, however, because wildlife programs have developed independently of entomology at Rutgers and the University of Massachusetts. State support at Delaware is smaller than at New Jersey or Massachusetts because of Delaware's small size. Like Delaware, both New Jersey and Massachusetts are rapidly urbanizing states that have retained agriculture as an important component of their economies. Another comparison of interest is that with Rhode Island, a state closer in size to Delaware. A final comparison can be made with the wildlife program at Frostburg State University in Maryland since this is a relatively new program that integrates wildlife, botany, and invertebrate biology, and thus may serve as a model. Although Frostburg is considerably smaller than the University of Delaware, the Biology department has 14 faculty, a third more than us, and is becoming increasingly respected in the wildlife field.

Rutgers Department of Entomology has 12 tenured or tenure-track faculty members as compared to our 6 entomology faculty. Rutgers has 16 graduate students (M.S. and Ph.D.) while Delaware has 26, (21 currently full time). Rutgers' interdisciplinary Department of Ecology, Evolution, and Natural Resources offers degrees in Ecology and Natural Resources. Their M.S. and Ph.D. Degrees (approx. 100 students) are in Ecology and are supported by 70 faculty from several departments, including 7 with interests related to wildlife ecology, conservation, or management.

The entomology department at the University of Massachusetts (Amherst) has recently merged with the departments of plant pathology and plant and soil sciences to become the Department of Plant, Soil, and Insect Sciences. The department no longer offers an undergraduate degree in entomology but 8 entomology faculty within the department support 14 graduate students in M.S. and Ph.D. programs. The Department of Natural Resources Management at U. Mass. has 40 faculty, 13 of which work in wildlife-related fields. The department offers a B.S. as well as an M.S. and Ph.D. in Wildlife and Fisheries Conservation.

At the University of Rhode Island, entomology is part of the Plant Sciences Department, while wildlife biology is part of the Department of Natural Resources Science. Both reside in the College of the Environment and Life Sciences. Of 13 faculty in Plant Sciences, 5 are entomologists; of 14 faculty in Natural Resource Science, 6 are in wildlife biology or ecology, including avian and waterfowl ecology; other disciplines in this department include conservation biology, forest ecology, watershed modeling, wetland ecology, remote sensing, and soils. The M.S. and Ph.D. in Environmental Sciences include an option in Wildlife. Approximately 25-30 graduate students study topics ranging from soil chemistry to water quality and forest ecology to wildlife ecology.

The Biology Department at Frostburg State University offers an M.S. in Wildlife & Fisheries Biology and an M.S. in Applied Ecology & Conservation. The department has 14 faculty (4 wildlife, 3 botany, 2 invertebrate biologists/entomologists, 3 fisheries, and 2 environmental toxicology). Two of the wildlife faculty members teach wildlife courses, whereas the other 2 wildlife faculty members teach general biology courses.

To summarize, the Department of Entomology and Wildlife Ecology at the University of Delaware compares favorably with other departments from similarly sized states and with similar agricultural resource bases in terms of the size and viability of its undergraduate and graduate programs. The department has about 120 undergraduate majors each year, the second largest undergraduate program in the college. There are no other departments in the nation, however, that view insects and vertebrate wildlife as inseparable components of healthy ecosystems. This allows us to offer a unique perspective to our students, which is serving them well in competitive markets.

Recently the Department of Entomology and Wildlife Ecology, in collaboration with the Northern Research Station of the U.S. Forest Service, has initiated what we are calling the “Center for Managed Ecosystems.” The Center is comprised of scientists who are concerned about the long-term sustainability of biodiversity in the eastern U.S. and includes members of the Department of Entomology and Wildlife Ecology, the Department of Plant and Soil Science, Stroud Water Research Center, Delaware Invasive Species Council, Delaware Department of Natural Resources and Environmental Control, Delaware Nature Society, University of Delaware Botanical Garden, and the U.S. Forest Service.

F. Describe other strengths

Perhaps our greatest strength is the ability to fill the academic niche of organismal biology, a niche that is not filled by UD’s Biology Department. The advances in molecular biology that triggered huge funding increases for biomedical research in the past decade have simultaneously eroded support for (and thus interest in) the study and conservation of whole organisms and the ecosystems they drive. Students interested in organismal biology, behavior, and ecology have found their interests met by our department. We are pleased to be able to offer these disciplines for the University and firmly believe that the unprecedented stress being placed upon life support systems throughout the globe by the expanding human enterprise makes this information more timely and essential than ever. We interact occasionally with Marine Studies programs also in respect to organismal biology and conservation. Marine Studies graduate students periodically enroll in our ENWC 805 course on insect-plant chemical ecology.

Another strength of our department comes from its central location relative to major natural history museums (USNM Smithsonian; Philadelphia Academy of Natural History, Museum of Natural History, N.Y.); the USDA/ARS Beneficial Insects Research Laboratory, Newark DE; U.S.G.S. Patuxent Wildlife Research Center, Patuxent, MD; Stroud Water Research Center, Avondale, PA; and various agricultural product industries. All of these have lead to research and employment opportunities for our students, and funding opportunities for our faculty. DuPont Agricultural Products has had an especially close relationship with our department, with Stine-Haskell Research Center, its primary research facility for pest control worldwide, located in Newark, DE. DuPont-owned Chesapeake farms, near Chestertown, MD, also provides a venue for research both in entomology and wildlife studies.

We particularly benefit from the close proximity of the Beneficial Insects Introduction Research Unit, located on the grounds of UD’s College of Agriculture and Natural Resources. Adjunct faculty there supply jobs and internships for undergraduates, and facilities and advice for our

graduate students in entomology. Adjuncts such as Michael Smith are particularly active with our students and have sat on several graduate committees. A recent hire there, Jian Duan, has expressed interest in cooperative research with our graduate programs. We have similarly productive relationships with scientists at the Stroud Water Research Laboratory such as David Funk, Bernard Sweeney, and John Jackson.

The department enjoys the exclusive use of a 35 acre fenced woodlot on the Experiment Station farm in Newark, DE for teaching and research. Among others, the woodlot has hosted a 31-year study of the population dynamics of wood thrush, which has generated the longest continuous data set of a Neotropical migrant in the country. This study has been invaluable from the perspective of studying bird fitness in a fragmented landscape and long-term population declines in a species of conservation concern. We also benefit logistically from having the Experiment Station farm on campus directly adjacent to our offices, labs, and teaching facilities. Moreover, numerous natural areas such as Fair Hill, MD, White Clay Creek State Park, Rittenhouse Park, Iron Hill Park, Lums Pond, etc., are nearby and accessible for field trips and research.

III. ENROLLMENT, ADMISSIONS AND FINANCIAL AID

A. Enrollment

Seven students are currently in our Ph.D. program (Table 4). There have been 56 degrees granted from our graduate program over the past eight years (Table 5) with 10 Master's students graduating in the last year. Three doctoral degrees have been awarded thus far from our new Ph.D. program, one each in 2005, 2006, and 2007. One Ph.D. student has applied to receive the degree at the end of spring semester of 2008. Nearly all of our graduates (and all of our PhD graduates) have gained employment within the field or have transitioned to advanced degree programs. Among the 53 Master's graduates in the past eight years, 20 have gone on to a doctoral program.

B. Admission Requirements

Minimum requirements for admission to the master's and doctoral degree programs are an undergraduate academic index of 2.8 overall and 3.0 in the major field of study and a combined score of 1050 on the verbal and quantitative portions of the GRE. Graduate GPA (if applicable) should be at least 3.2. A paper-based TOEFL score of at least 550 (or 213 computer-based) is required for international students. The Advanced GRE in Biology is required with a minimum score of 580 for Ph.D. applicants, and it is strongly recommended for M.S. applicants. Scores are used for making course program recommendations and as additional information for awarding graduate assistantships.

Applicants for the M.S. degree must indicate choice of major. At any time before or after admission, an applicant or a student may request to change major. If the change is granted, all pertinent application and degree requirements of the new program will apply. An applicant should have passed courses in introductory biology and general ecology. Students lacking either of these courses must complete them within the first year of graduate study with a grade of B or better.

Applicants for all degree programs must submit one official transcript of all previous college records, provide a statement of objectives and interests, and have three recommendation forms completed by appropriate mentors and submitted to the University Office of Graduate Studies. At least two of these should be from faculty of the applicant's major department. The statement of interests should include the specialty area(s) within the program and possible faculty member(s) with which the applicant would like to work. Applicants for the Ph.D. degree are strongly encouraged to submit additional evidential material that attests to the applicant's ability to carry out and benefit from doctoral work. This material can include Master's theses, term papers, research reports, grant proposals, publications, evidence of teaching or professional work experience, etc. Ph.D. applicants must also identify a faculty member with whom they would like to conduct their research, and that person must agree to act as the student's advisor before the applicant will be accepted into the program. For most applicants, completion of an M.S. degree is required before admission to the doctoral program. However, exceptionally well-qualified students may be admitted directly to the Ph.D. degree program.

C. Student Expenses and Financial Aid

There is not a need for any additional required student expenses beyond the traditional books and supplies, personal computer, extensive laboratory fees, fees for graduate and professional courses of study, and etc.

IV. CURRICULUM SPECIFICS

A. Institutional Factors

In the fields of Entomology and Wildlife Ecology, the Ph.D. is considered the terminal degree for full professional development. Among the land grant institutions, virtually all offer the Ph.D. in Entomology or in majors in some aspect of Wildlife Biology.

B. Describe the curriculum

The department's document covering Graduate Student Requirements and Policies is provided in Appendix A. The requirements and policies have been updated periodically to implement the several changes made in our program offerings and to facilitate consistency in administering certain aspects of our programs. For example, we added the section for M.S. students who plan to continue in the Ph.D. program as more of our M.S. students requested reclassification to begin their doctoral studies. Our course requirements have changed as the Wildlife Ecology side of our graduate programs have grown and matured. For example, in 2000 we required ENWC 614, Insect Ecology, for our graduate degrees. This course has evolved into 814, Advanced Ecology, to accommodate more graduate level topics and to cover a broader range of upper level ecology of animals and plants. We have also strengthened or added offerings in Herpetology, Ornithology, Wildlife Population Dynamics, Wildlife Research Techniques, and Conservation Genetics to better accommodate the graduate programs not only in Wildlife Ecology, but also in Entomology.

V. RESOURCES AVAILABLE

A. Library Resources

The statement of library resources in Appendix D of the original proposal for Provisional Status of the Ph.D. program is as appropriate currently as it was when this program began. The library resources available in the College of Agriculture and Natural Resources Library and Morris Library have served our graduate programs well and we do not anticipate a need for any additional special resources.

B. Faculty / Administrative Resources

The Department of Entomology and Wildlife Ecology at the University of Delaware has 8 tenure-track faculty lines and 1 non-tenure track faculty line (Table 6). Currently 6 lines focus on entomological issues (although two faculty holding these lines, Dewey Caron and Clifford Keil, have announced retirement dates), while 3 cover wildlife issues. Typically wildlife programs have developed independently of entomology and are part of larger forestry or fisheries departments. Our growing focus on conservation issues suggests comparisons with conservation biology departments. However, like wildlife programs, conservation programs are usually nested within larger biology departments.

C. External Funding

Our graduate program currently serves 26 students (Table 4). Twenty of these are on full-time funding through a research assistantship (14), teaching assistantship (4), or fellowship (2). This level of support would not be sustainable without help from resources in the Biology department; some of our students serve as TAs in the Biology department each semester. Our graduate program has benefited from this relationship for many years, but Biology TA support could end at any time, particularly if the graduate program in Biology expands.

VI. RESOURCES REQUIRED

A. Learning Resources

We have no additional need for learning resources above what have already been identified elsewhere in this self-study.

B. Personnel Resources

We believe it takes a minimum of five faculty to provide a critical mass for a high quality graduate program and undergraduate program in a field of study. Thus, ten faculty members are necessary in our department to maintain competitively high quality graduate programs within our two fields of study. Currently, we have eight tenure track and one non-tenure track faculty positions. The panel for our recent academic program reviewer recommended adding at least one faculty position, thus broadening our range of specialties within the discipline and reducing our per faculty teaching demands at the graduate level (Appendix B).

C. Budgetary Needs

There are no special budgetary needs expected.

VII. IMPLEMENTATION AND EVALUATION

A. Implementation Plan

The transition of our graduate program over the past 9 years has taken several steps. We originally proposed the Ph.D. program in 1999 with the title Entomology and Applied Ecology to be consistent with our department name and with the same title as the Master's program. Two concentrations were added later to the Master's, Entomology and Applied Ecology, to represent two areas of focus in the major. A formal change in the department name to Entomology and Wildlife Ecology was made in 2003. As our graduate programs matured, it became apparent that we needed to have graduate majors that more accurately represented the two fields of study in the department, Entomology and Wildlife Ecology. We added the M.S. program with an independent major in Wildlife Ecology in 2004, but kept the M.S. in Entomology and Applied Ecology. Finally, in 2007, we streamlined our Master's programs by removing Applied Ecology and offering two independent majors in Entomology and Wildlife Ecology. At the same time, we changed the Ph.D. program name to Entomology and Wildlife Ecology and added two concentrations, requiring students to select Entomology or Wildlife Ecology to identify their area of specialty. We have reached our goal of having two strong Master's programs and a Ph.D. program that allows qualified students to pursue doctoral studies under the guidance of faculty representing the two areas of focus in the department. In the future, we hope to maintain a balance of graduate students between the two fields of study, Entomology and Wildlife Ecology. This can only be accomplished by maintaining a balance in faculty expertise to serve the research and courses necessary to support the graduate programs in these two fields.

B. Assessment Plan

Approximately every 5 to 7 years, our entire academic program goes through the University's Academic Program Review (APR). The most recent APR was completed during the fall of 2007. The graduate program portion of that review is presented in Appendix B. Each time our department submits a change to our graduate curriculum or graduate policy, it is reviewed by our department faculty as well as the Faculty Senate Graduate Studies Committee, whereupon valuable recommendations are made by these assessments. We have plans to administer an exit questionnaire in the future as part of our department's assessment of educational learning objectives.

VIII. APPENDICES

- A. Graduate Student Requirements and Policies
- B. Graduate Portion of 2007 Academic Program Review

Table 1. Master's programs applications received, applicants offered admission, and students admitted.

	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01	'02	'03	'04	'05	Ave
# of Applications	11	12	11	21	11	8	15	14	11	15	12	15	19	23	14	14.13
# of Offers	6	11	10	13	7	6	15	10	8	8	6	8	14	11	6	9.27
# of Admits	2	8	7	8	4	4	6	8	8	3	4	5	6	10	6	5.93

Table 2. Master's Graduate Record Examination scores for applications received, applicants offered admission, and students admitted.

GRE Verbal

	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01	'02	'03	'04	'05	Ave
Applied	510	478	484	484	506	492	526	444	526	487	565	481	503	534	527	503
Offered	583	500	493	665	529	508	526	471	545	513	624	523	507	565	550	540
Admitted	550	543	497	660	513	572	500	484	545	507	643	528	488	573	550	543

GRE Math

	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01	'02	'03	'04	'05	Ave
Applied	582	563	599	590	612	588	643	607	589	613	600	599	625	616	643	605
Offered	607	582	604	655	674	674	643	615	613	594	672	604	644	618	622	628
Admitted	615	563	634	660	693	693	613	596	613	567	660	610	642	630	622	627

GRE Total

	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01	'02	'03	'04	'05	Ave
Applied	1092	1041	1083	1073	1118	1080	1169	1051	1114	1100	1165	1080	1128	1150	1170	1108
Offered	1190	1082	1097	1321	1203	1182	1169	1086	1158	1107	1296	1127	1151	1184	1172	1168
Admitted	1165	1106	1131	1320	1205	1264	1113	1080	1158	1073	1303	1138	1130	1203	1172	1171

Table 3. Ph.D. program data.

Ph.D. Applications

	'99	'00	'01	'02	'03	'04	'05	'06	'07	Ave
# of Applications		3	3	6	2	3	8			4.17
# of Offers		2	1	4	1		4			2.40
# of Admits		1		2	1		3			1.75

Ph.D. Graduate Record Examination Scores

GRE Verbal	'99	'00	'01	'02	'03	'04	'05	'06	'07	Ave
Applied		570	390	530	505	270	506			462
Offered		580	310	538	620		565			523
Admitted		690		460	620		580			588

GRE Math	'99	'00	'01	'02	'03	'04	'05			Ave
Applied		700	615	717	575	545	585			623
Offered		745	640	688	690		603			673
Admitted		730		645	690		623			672

GRE Total	'99	'00	'01	'02	'03	'04	'05			Ave
Applied		1270	1005	1247	1080	815	1091			1085
Offered		1325	950	1225	1310		1168			1196
Admitted		1420		1105	1310		1203			1260

Table 4. Graduate Students in Entomology and Wildlife Ecology, Degree Status, and Support Source

Entomology and Wildlife Ecology Graduate Student Status for Spring 2008

Student	Status	Advisor	Support Source	Entr T	Sem #	Cmpl T
Donovall	Sust	Bartlett	Own Funds	04F	7	08S
Gonzon	Sust	Bartlett	Own Funds	05F	5	08S
Jennings	Full	Bowman	Athletic GA	05F	5	08S
Nazdrowicz	Full PhD	Bowman	BISC NSF Fellowship	03F	9	08S
Northrop	Part	Bowman	Own Funds	02F	11	08S
Springer	Full	Bowman	Mac Stinnis RA	07J	1	09F
Tymkiw	Full	Bowman	Hatch RA #3	07J	1	09F
Stragar	Sust	Caron	Own Funds	04F	7	08S
O'Connor	Full PhD	Gingrich	Dissertation Fellowship	05S	6	08S
Caranci	Full	Gingrich/Mason	Ento TA	07F	1	09F
Frye	Full PhD	Hough-G	Hatch RA #1	06F	3	10S
Lake	Full PhD	Hough-G	JHG Grant RA	07F	1	11S
Fredericks	Part PhD	Mason/King	Own Funds	05F	5	10S
Razze, Janine	Full	Mason	BISC TA #2	08S	0	10S
Goodwin	Full	Shriver	WGS Grant RA	07S	2	09S
Pepper	Full	Shriver	WGS Grant RA	06J	3	08F
Warner	Full	Shriver	Hatch RA #2	06J	3	08F
Beal	Full PhD	Tallamy	Hatch RA #5	06F	3	10S
Philips	Full	Tallamy	Tuition Scholarship	07S	2	09S
Reed	Full	Tallamy	BISC TA #1	07F	1	09F
Ballard	Full PhD	DWT/JHG/VDA	VDA-DWT-JHG Coop RA	06F	3	10S
Collins	Full	Williams	Grad Fellow	05J	5	08S
Cramer	Full	Williams	CKW Grant RA	06J	3	08F
Ladin	Full	Williams	CKW Grant RA	07F	1	09F
Lohr	Full	Williams	Hatch RA #4	06S	4	08S
Ferris	Full	Williams/D'Amico	Wildlife TA	06J	3	08F

Total Students = 26; 21 full-time, 2 part-time, 3 sustaining, 20 on 100% support. Among these, 9 are indicated as finishing their current degree program by May 2008.

Table 5. Recent Graduates and Career Placement

Year	Student (Advisor)	Employment/Placement Status
Ph.D.		
2007	Heckscher (Roth)	Avian Biologist, Delaware Dept. Natural Resources
2006	Brown (Tallamy)	Instructor in Biology, Kutztown Univ.
2005	Williams (Mason/Gingrich)	Mosquito & Vector Control Coordinator, Hudson Co , NJ
M.S.		
2007	Alsfield (Bowman)	JCM Environmental/Environmental Specialist
	Anderson (Mason/Gingrich)	Ph.D. program, Entomology, Pennsylvania State Univ.
	Banning (Bowman)	Researcher Assistant, Wildlife, Univ. Delaware
	Colligan (Bowman)	Wildlife Biologist, USDA, Animal Plant Health Insp. Service, Syracuse, NY
	DiBona (Bowman) (Dec 07 Grad)	Game Bird Biologist, Del. Dept. Natural Resources
	Ellison (Mason/Flexner)	Research Assistant, USDA, Agric. Research Service, Florida
	Goldstein (Mason)	Faculty Research Assistant, Entomologist, Univ. Maryland
	Haughey (Tallamy)	Biologist, Del. Dept. Natural Resources
	Janis (Mason)	Insecticide Registration Coordinator, DuPont
	Lake (Hough-Goldstein)	Ph.D. program, Entomology & Wildlife Ecology, Univ. Delaware
2006	Ballard (Tallamy)	Ph.D. program, Entomology & Wildlife Ecology, Univ. Delaware
	Beal (Tallamy)	Ph.D. program, Entomology & Wildlife Ecology, Univ. Delaware
	Frye (Hough-Goldstein)	Ph.D. program, Entomology & Wildlife Ecology, Univ. Delaware
	Misiewicz (Bowman)	Wildlife Biologist, USDA, Animal Plant Health Inspect. Service
2006	Rhoades (Bowman)	Regional Wildlife Biologist, Del. Dept. Natural Resources
	Steiger (Keil/D'Amico)	Ph.D. program, Molecular Biology, Univ. California
	Wall (Roth)	Director, Environmental Policy, Academy of Natural Sciences, Philadelphia
	Zuefle (Tallamy/D'Amico)	Entomologist, Delaware Mosquito Control Dept.
2005	Cerqueira (Caron)	High School Biology Teacher
	Judy (Roth)	Preserve Manager, Texas City Prairie Preserve, Texas
	McGuire (Keil)	Urban Park Ranger Entomology, NY City Dept. Parks & Rec.
	Rogerson (Bowman)	Game Mammal Biologist, Del. Dept. Natural Resources

Year	Student (Advisor)	Employment/Placement Status
2004	Caci (Mason/Gingrich)	Major in U.S. Army, Environmental Science Officer
2004	North (Mason)	Manager, Nursery and Garden Store in Pennsylvania
	O'Connor (Keil)	Ph.D. program, Entomology & Wildlife Ecology, Univ. Delaware
	Powell (Tallamy)	Ph.D. program, Entomology, North Carolina State Univ.
	Stearns (Tallamy)	Ph.D. program, Biology, Univ. Texas
	Walsh (Tallamy)	Karate Instructor
2003	Colpetzer (Hough-Goldstein)	Entomologist, USDA, Animal Plant Health Insp. Service, Raleigh, North Carolina
	Heckscher (Roth)	Ph.D. program, Entomology & Wildlife Ecology, Univ. Delaware; Zoologist, Del. Division of Fish & Wildlife
	Jennings (Tallamy)	Last known-U.S. Forest Service, Connecticut
	Kipp (Bowman)	Environmental consultant for a firm in California
	Nazdrowicz (Bowman)	Ph.D. program, Entomology & Wildlife Ecology, Univ. Delaware
	Wilson (Hough-Goldstein)	Public Affairs Spec., USDA, Coop. St. Res. Ed. Ext. Ser.
2002	Fenstermacher (Tallamy)	Independent landscaping business owner in Pennsylvania
	Johnston (Roth)	Asst. Prof. Wildlife. Ecology, Univ. Maine, Presque Isle
	Park (Caron)	Ph.D. program, Entomology, Univ. California, Riverside
	Vandarwarka (Hough-Goldstein)	High School Biology Teacher
2001	Cai (Mason)	Pursuing 2 nd M.S. in Horticulture, Univ. Missouri
	Fredericks (Hough-Goldstein)	Ph.D. program, Entomology & Wildlife Ecology, Univ. Delaware; Manager, Home Paramount Corp., Philadelphia., PA
	Gillespie (Tallamy)	Ph.D., Mol. Biology Univ. Texas, Univ. Maryland Post Doc.
	Lomberk (Tallamy)	Unknown
	Parr (Tallamy)	Ph.D., Environmental Toxicology, Univ. Texas
	Price (Hough-Goldstein)	Ph.D., Ecology & Evolution, Rutgers Univ., Post Doc., AMNH, NY
	Snyder (Mason)	Ph.D. program, Biology, Univ. Missouri
	Witmer (Hough-Goldstein)	High School Biology Teacher
2000	Darlington (Tallamy)	Ph.D., Evolutionary Biology, Pennsylvania State Univ.
	Kirk (Keil)	DuPont, Entomologist
	Lin (Wood)	Ph.D. program, Evolutionary Biology, SUNY, Stony

Year	Student (Advisor)	Employment/Placement Status
		Brook
	Niederriter (Hough-Goldstein)	Non-Game Wildlife Biologist, Del. Dept. Natural Resources
	Reed (Keil)	Instructor in Biology, Univ. Delaware
	Samel (Keil)	DuPont, Toxicologist
	Walther (Hough-Goldstein)	Ph.D., Ecology, S. Illinois Univ., Species Coordinator, USFWS

Table 6. Departmental Personnel Listing

PERSONNEL
DEPARTMENT OF ENTOMOLOGY AND WILDLIFE ECOLOGY
September 2007

FACULTY

DOUGLAS W. TALLAMY – Chairperson and Professor. (25% Teaching, 45% Research, 25% Administration, 5% Service) B.S., Biology; M.S., Ph.D., Entomology (Maryland). Insect ecology and ethology, the evolution of social behavior in tingids (Hemiptera), plant-insect interactions. Teaches Advanced Ecology, Behavioral Ecology, Debates in Conservation Biology, and Conservation of Tropical Biodiversity (in Costa Rica).

CHARLES R. BARTLETT – Assistant Professor and Curator of Insect Reference Collection. (45% Teaching, 45% Research, 10% Service) B.S., Natural Resources; M.S. and Ph.D., Entomology (North Carolina State Univ.). Systematics (Homoptera), conservation. Teaches, Insect Identification – Taxonomy, Insect Field Taxonomy, Insect Structure and Function, Larval Taxonomy, and Elements of Entomology.

JACOB L. BOWMAN – Associate Professor. (44% Teaching, 55% Research, 1% Service) B.S., Forestry and Wildlife; M.S., Wildlife Ecology; Ph.D., Forest Resources (Mississippi State). Wildlife ecology, conservation, habitat management. Teaches Wildlife Research Techniques, Wildlife Management, Mammalogy, and Conservation of African Wildlife (in Tanzania).

DEWEY M. CARON - Professor and Extension Entomologist. (50% Teaching, 50% Service) B.S., Zoology; M.S., Ecology; Ph.D., Entomology (Cornell). Apiology, insect behavior and general entomology. Teaches Apiology and Apiculture, and Elements of Entomology.

JUDITH A. HOUGH-GOLDSTEIN – Professor. (25% Teaching, 74% Research, 1% Service) B.A., Biology; M.S., Ph.D., Entomology (Cornell). Plant-insect interactions, biological control, insect pest management. Teaches Entomology Laboratory, Insect Pest Management, and New Student Seminar.

CLIFFORD B.O. KEIL - Associate Professor. (39% Teaching, 60% Research, 1% Service) B.S., Natural Resources; M.S., Ph.D., Entomology (VA Polytech. Inst. & State Univ.). Insect genetics, genetics of insecticide resistance, insect pathology, mushroom insects. Teaches Tropical Forest Ecology.

CHARLES E. MASON - Professor. (33% Teaching, 62% Research, 5% Service) B.S., M.S., Ph.D., Entomology (Kansas State). Ecology of stalk boring insects, biological control, chemical ecology. Teaches Biological Control, Insect-Plant Chemical Ecology, Comparative Terrestrial and Marine Ecology, and Capstone Senior Seminar.

W. GREGORY SHRIVER - Assistant Professor. (39% Teaching, 60% Research, 1% Service) B.S., Wildlife Management; M.S., Wildlife Conservation; Ph.D., Environmental Forest Biology

(SUNY). Avian ecology, monitoring, applied conservation. Teaches Conservation Biology and Ornithology.

CHRISTOPHER K. WILLIAMS – Assistant Professor. (39% Teaching, 60% Research, 1% Service) B.S., Zoology; B.S., Botany (Miami University); M.S., Ph.D., Wildlife Ecology (University of Wisconsin). Wildlife ecology, population dynamics, animal behavior. Teaches Population Ecology and Wildlife Habitat Management.

EXTENSION SPECIALISTS

BRIAN A. KUNKEL, - Ornamentals IPM Extension Specialist. B.S., General Biology; M.S. Entomology; Ph.D. Entomology (The Ohio State University). IPM programs with ornamentals in nurseries, landscape, and greenhouses.

JOANNE M. WHALEN - Extension Pest Management Specialist, B.S., Horticulture; M.S., Entomology (Delaware). IPM programs of Delaware crops and economic entomology.

SUSAN WHITNEY KING - Extension Specialist, Pesticides, Urban Entomology. B.S., Zoology; M.A., Biology; Ph.D., Entomology, (North Carolina State Univ.). Pesticide Applicator training, pesticide impact assessment, IR-4 registration.

PROFESSIONAL STAFF

JEFFERY J. BULER – Radar Ornithologist. Behavior and ecology of avian migration. Application of weather surveillance radar to study animal movement. Landscape ecology. Conservation biology.

JOHN B. GINGRICH - Medical Entomologist. Surveillance of West Nile Fever Vectors. Teaches Medical and Veterinary Entomology.

KIMBERLEY SHROPSHIRE – Research specialist.

WILLIAM J. CISSEL – Extension Associate II.

PART-TIME INSTRUCTIONAL STAFF

JON COX – Photographer. Teaches Nature/Wildlife Photography.

ROLAND R. ROTH – Retired Professor Emeritus. B.S., M.S., Ph.D., Zoology (Illinois). Conservation biology, ecology, and ornithology.

JAMES WHITE – Assoc. Director, Land & Biodiversity Management, Delaware Nature Society. Teaches Herpetology.

ADJUNCT FACULTY

JAMES BARRY – Research Biologist, DuPont Stine-Haskell Research Center, Newark, DE. Biological activity and spectrum characteristics of novel insecticides.

SHAWN CARTER – Inventory & Monitoring Coordinator, Center for Urban Ecology, National Park Service. Reserve design, biodiversity theory, and the role of spatial scale and habitat complexity in determining patterns of community structure.

VINCENT D’AMICO – Insect Pathologist, US Forest Service. Disease dynamics, insect disease transmission, invertebrate pathology.

WILLIAM H. DAY – Research Entomologist, Beneficial Insects Introduction Research, USDA. Research on evaluation of control of alfalfa weevil, *Hypera postica*, by introduced parasites, and monitoring of introduced parasites of lygus bugs and other mirids.

LINDSEY FLEXNER – Research Biologist, DuPont Co. Insect pathology, use of natural and bioengineered viruses for insect control.

DINA FONSECA – Associate Professor, Rutgers University. Infectious Diseases, Mosquito Control, and Evolutionary Ecology. Microbiology, Molecular Biology, Genetics, and Ecology.

ROGER W. FUESTER - Research Entomologist and Director, Beneficial Insects Introduction Research, USDA. Biological control of birch leafminer, *Fenusa* parasites, evaluation of established natural enemies, screening of new candidate species from Europe and surveys to determine establishment of introduced aphid parasites.

JON K. GELHAUS – Philadelphia Academy of Natural Sciences. Insect systematics and biogeography, especially crane flies (Diptera: Tipulidae).

RUSSELL GREENBURG – Head, Smithsonian Migratory Bird Center. Habitat selection, the ecology and evolution of migration, interspecific interaction, and use of man-modified tropical habitats.

CALEB W. HOLYOKE - Research Chemist, DuPont Co. Chemistry of biologically active compounds and toxicology.

KEITH R. HOPPER – Beneficial Insects Introduction Research, USDA. Theory and practice of biological control introductions, parasitic Hymenoptera.

JOHN K. JACKSON - Assistant Curator, Stroud Water Research Center, Avondale, PA. Aquatic invertebrates and stream ecology.

CALVIN KEELER – Joint appointment, Dept. of Animal & Food Sciences, Univ. Delaware. Molecular virology.

WILLIAM MEREDITH – Environmental Program Administrator, Delaware Department of Natural Resources. Mosquito biology and population management and marshland ecology.

DANIEL OTTE – Philadelphia Academy of Natural Sciences. Insect systematics and evolution, especially Orthoptera.

PAUL SCHAEFER – Research Entomologist, Beneficial Insects Introduction Research, USDA. Exotic enemies of Mexican bean beetle, gypsy moth biocontrol agents, and egg parasites of Colorado potato beetle.

MICHAEL T. SMITH – Research Entomologist, Beneficial Insects Introduction Research, USDA. Biological control, Asian longhorned beetle.

JEAN L. WOODS – Curator of Birds, Head of Collections and Research Division, Delaware Museum of Natural History. Bird behavior and evolution.

APPENDIX A

GRADUATE STUDENT REQUIREMENTS AND POLICIES
DEPARTMENT OF ENTOMOLOGY AND WILDLIFE ECOLOGY
UNIVERSITY OF DELAWARE
NEWARK, DELAWARE
Effective September 2007

(Approved by the University Faculty Senate Graduate Studies Committee November 8, 2006)

The Department offers programs leading to the Master of Science (M.S.) in Entomology, M.S. in Wildlife Ecology, and the Doctorate of Philosophy (Ph.D.) in Entomology and Wildlife Ecology. Graduate students in these fields couple a focus on insects or vertebrates with a broad knowledge of other related fields of biology, especially ecology. Each candidate's program is planned with the help of the advisor and graduate committee. The M.S. degree programs prepare students for pursuit of the Ph.D. and careers in entomology, wildlife ecology, and other biological disciplines. Students pursuing the Ph.D. degree program in Entomology and Wildlife Ecology have to satisfy the requirements in at least one of two concentrations, Entomology or Wildlife Ecology. The M.S. in Entomology, in place since 1949, was changed to M.S. in Entomology and Applied Ecology in 1999, then back to M.S. in Entomology in 2007. The M.S. in Wildlife Ecology was added in 2004. The Ph.D. degree program received provisional status effective September 1, 1999, and is scheduled to be reviewed for permanent status during fall of 2007. The department modified its name in 2003, replacing "Applied" with "Wildlife" to accommodate the emphasis on wildlife in the curricula.

ADMISSION REQUIREMENTS

Minimum requirements for admission to the master's and doctoral degree programs are an undergraduate academic index of 2.8 overall and 3.0 in the major field of study and a combined score of 1050 on the verbal and quantitative portions of the GRE. Graduate GPA (if applicable) should be at least 3.2. A paper-based TOEFL score of at least 550 (or 213 computer-based) is required for international students. The Advanced GRE in Biology is required with a minimum score of 580 for Ph.D. applicants, and it is strongly recommended for M.S. applicants. Scores are used for making course program recommendations and as additional information for awarding graduate assistantships.

Applicants for the M.S. degree must indicate choice of major. At any time before or after admission, an applicant or a student may request to change major. If the change is granted, all pertinent application and degree requirements of the new program will apply. An applicant should have passed courses in introductory biology and general ecology. Students lacking either of these courses must complete them within the first year of graduate study with a grade of B or better.

Applicants for all degree programs must submit one official transcript of all previous college records, provide a statement of objectives and interests, and have three recommendation forms completed by appropriate mentors and submitted to the University Office of Graduate Studies. At least two of these should be from faculty of the applicant's major department. The

statement of interests should include the specialty area(s) within the program and possible faculty member(s) with which the applicant would like to work. Applicants for the Ph.D. degree are strongly encouraged to submit additional evidential material that attests to the applicant's ability to carry out and benefit from doctoral work. This material can include Master's theses, term papers, research reports, grant proposals, publications, evidence of teaching or professional work experience, etc. Ph.D. applicants must also identify a faculty member with whom they would like to conduct their research, and that person must agree to act as the student's advisor before the applicant will be accepted into the program. For most applicants, completion of an M.S. degree is required before admission to the doctoral program. However, exceptionally well-qualified students may be admitted directly to the Ph.D. degree program.

Admission to the graduate program is selective and competitive based on the number of well-qualified applicants and the limits of available faculty and facilities. Those who meet stated minimum requirements are not guaranteed admission, nor are those who fail to meet all of the requirements necessarily precluded from admission if they offer other appropriate strengths. Application for fellowship, tuition scholarship, or assistantship financial aid is a part of the admission application form and is made at the time of application. Applications being considered for financial support should be completed by February 1 for summer or fall terms and November 1 for entering in spring term. For further details, contact the chairperson of the department's Graduate Admissions Committee.

M.S. STUDENTS WHO PLAN TO CONTINUE IN THE PH.D. PROGRAM

While it is possible to go directly to the Ph.D. program, the Department Faculty prefers that students complete the M.S. degree before being admitted or reclassified into the doctoral degree program in Entomology and Wildlife Ecology. Students already matriculated in the M.S. Program in Entomology or Wildlife Ecology and who plan to go on for the doctoral degree may, at an appropriate time, request reclassification to the Ph.D. program as a pre-candidate in lieu of reapplying for graduate study. The department Graduate Admissions Committee will review the request using the same criteria applied to all applicants to the Ph.D. program. Materials to submit with the request should include score for Advanced GRE in Biology, any updated information since the M.S. application (such as new GRE general test scores), three new letters of recommendation (one should be from the M.S. major professor), and written material resulting from the M.S. research completed to date. Requests should be submitted to the department Graduate Program Director in one of the following ways: 1) if sought before completing the master's degree, submit a letter of request for reclassification to the Ph.D. program; 2) if sought at the time of submitting the Application for Advanced Degree for the master's degree (last semester of M.S. program), check the appropriate box on the form indicating that you plan to continue in the doctoral degree program and submit a letter of request for reclassification; 3) if sought after completing the M.S., submit a new application with fee to the Office of Graduate Studies. Requests under the conditions for items 1 and 2 should include a graduate studies change of classification form. If the department does not approve the request for reclassification from the M.S. program to the Ph.D. program, the M.S. degree will be considered the terminal degree for the candidate.

GRADUATE COMMITTEE

Before an applicant is admitted to a program, a regular faculty member from the department must agree to serve as the major academic advisor for the student's committee. An adjunct faculty member, extension professional, or limited term researcher can serve as the major research co-advisor with the major academic advisor. The student (in consultation with the advisor) will form a graduate committee by the end of the first term. The composition of the graduate committee must be approved by the Department Chair and should be confirmed by memo from the advisor to the student with copies to the student's file and to committee members. The student may request in writing to the Department Chair that changes be made in the graduate committee at a later date. A committee meeting should be held as soon as possible to help plan the student's programs of course work and research.

The graduate committee for the M.S. should consist of the student's advisor, one other faculty member from inside the Department, and one expert from outside the Department. The graduate committee for the Ph.D. should consist of the major advisor and one other faculty member representing the student's primary area of study; one faculty member from within the department but from an area outside of the student's primary area of study; and one external member. The three primary committee members from the department must be full-time members of the faculty. The external member can be from another academic unit at the University of Delaware or from outside the institution. The external member should have an established record of publication in the field of the dissertation. Other members may be included on committees for either degree, up to a maximum of six. The Department Chair is an ex officio member of all committees and must be notified of all committee meetings. The committee should represent the areas of emphasis of the student's intended program and research. All members of the Ph.D. committee should hold the doctorate or an equivalent terminal degree.

Maintenance of steady, reasonable progress toward the degree is the responsibility of the student and the advisor. Regular meetings with the graduate committee to discuss progress are strongly encouraged and are required at least once each year. The department maintains a checklist to record completion of individual requirements for graduate study. Each student is expected to see the graduate program secretary periodically to update his or her progress. Any shortcomings in progress will be communicated in writing by the major advisor to the student and to the Office of Graduate Studies.

MASTER OF SCIENCE DEGREE REQUIREMENTS

General requirements for both M.S. majors are: (1) completion of at least 30 graduate credit hours, including a thesis describing independent research (6 credit hours); (2) passing an oral, general knowledge examination centering on the student's program of study; (3) presenting the thesis research in a formal departmental seminar; and (4) passing a thesis defense. Students in the Entomology major also must pass an Insect Family Recognition Test (see later section).

A. Credit, Course, and Grade Requirements

If a student has satisfactorily completed any of the required courses or an equivalent, the requirement may be waived.

Core M.S. Degree Courses for Both Majors

ENWC 814 – Advanced Ecology	3
ENWC 870 – Graduate Research Seminar	0*
ENWC 888 - Topics in Entomology & Applied Ecology	0*
ENWC 869 - Master's Thesis	6**
A graduate-level statistics course	3
<i>(Excluding data management courses such as FREC 674)</i>	

* *Students are expected to attend all department seminars and graduate student presentations throughout their period of graduate study.*

** *See sect. B, below*

Entomology Major

ENWC 605 Insect Structure & Function	4
ENWC 606 Insect ID – Taxonomy	3
One other 3-credit graduate level course primarily on insects	3
<i>(Obtain the list from the department office for qualified courses)</i>	

Wildlife Ecology Major

Two of the following:

ENWC 615 Wildlife Research Techniques	3
ENWC 618 Ornithology	3
ENWC 620 Behavioral Ecology	3
ENWC 624 Herpetology	3
ENWC 625 Mammalogy	3
ENWC 635 Wildlife Population Dynamics	3
ENWC 655 Conservation Genetics	3

Additional Coursework (both M.S. programs)

Students must earn additional graduate credit hours appropriate to the major to bring the total earned to at least 30 hours. A maximum of 3 credits in ENWC 666, 668, 866, and 868 and 6 credits of 869 can be applied to the degree. A list of the additional credit hours should be developed at the first committee meeting and confirmed in writing to the student by the advisor. Students may also be required by their committee to take coursework to make up a deficiency or to meet a prerequisite for a graduate level course. Any such requirements will be stated in writing by the student’s advisor following the first committee meeting. If the course can be taken for graduate credit, it will count toward the additional credits. Students in the Entomology Major lacking an undergraduate entomology course should register as a listener in ENWC 205 and/or 215 as needed and may earn one graduate credit to the satisfaction of the instructor(s) of the course(s).

Grade Requirements

Graduate students must maintain a minimum GPA of 3.00 to remain in good academic standing. GPA requirements are monitored by the Office of Graduate Studies according to the Graduate Studies Academic Probation Policy.

B. Thesis Requirement

By the end of the first year (preferably within the first 6 months) of graduate study, candidates must submit to their committee for review and approval, a written research proposal describing the intended thesis research, a detailed review of pertinent literature, the methods and procedures to be used, and a timetable for completion. The proposal may be reviewed and refined as necessary. If major emphasis is shifted in the research, the proposal should be amended with the advice and consent of the committee. Students are required to present their proposal in ENWC 870 (Graduate Research Seminar) to the department.

The thesis should reflect the student's ability to conduct independent scholarly research and to report the results in a manner worthy of publication. It must conform to the University's Thesis and Dissertation Manual (available on the University web site under graduate student academic policies) as to format and other mechanics. Students may write the thesis in a style suitable for a manuscript(s) ready for submission to a journal in consultation with their advisor.

The student may register for Master's Thesis (ENWC 869) during any term or terms to accumulate the required minimum of 6 credit hours. The student will receive a temporary grade of S or U until successful completion of the thesis, when the advisor will record a letter grade.

C. Insect Recognition Test (Required for Entomology Major only)

The Insect Recognition Test examines the student's ability to recognize the insect orders and 150 common insect families without the use of keys. A list of the families that may be included on the test is available in the department office. Students also must demonstrate an ability to use a taxonomic key. A faculty member appointed by the Department Chair administers the test, which is scheduled at the request of the student. A score of 85% is the minimum passing score. The test may be taken three times. The Insect Recognition requirement will be waived for any student who receives an A in ENWC 406/606, Insect ID -Taxonomy.

D. General Knowledge Examination

The General Knowledge Examination should be taken during the semester prior to the expected date of completing other requirements for the degree. The exam focuses on the student's training in his or her major and related areas. The principal examiners will be the student's graduate committee. Any University of Delaware faculty may attend and ask questions if time permits. No other student may attend the examination. Decisions concerning passage of the examination and recommendations stemming from it are decided by the committee based on a simple majority vote. If the first attempt results in failure, the second examination cannot be taken earlier than 90 days nor later than 365 days following the first examination. The examination may be taken only twice. A second failure results in dismissal from the program.

The examination shall be announced by the student's advisor at least one week in advance by memorandum to department faculty.

E. Department Seminar

A formal, public seminar detailing the student's research effort is required. The seminar should be of standard format and should utilize appropriate visual aids. Most seminars run 30-45 minutes with time for questions following the presentation. The student and advisor are responsible for arranging the details of the seminar presentation, including its announcement by the usual seminar notices at least one week in advance.

F. Thesis Defense

The Thesis Defense is conducted by the student's committee using the same procedures as the General Knowledge Examination. The student must provide each graduate committee member with a refined (but not final) draft of the thesis at least two weeks before the thesis defense. The date of the thesis defense should precede the University deadline for thesis submission by at least two weeks to allow sufficient time for any necessary changes. The Thesis Defense is usually scheduled directly after the student's Department Seminar (see E). The Seminar, including audience questions, will not constitute a thesis defense. The Thesis Defense is open to all University of Delaware faculty members. No other students may attend the Thesis Defense.

The defense shall be announced at least one week in advance by the distribution of a seminar notice (see E), which shall indicate that the defense will follow the seminar, or by memorandum to department faculty and by the posting of a notice in the Department.

DOCTOR OF PHILOSOPHY DEGREE REQUIREMENTS

A. Course Requirements

Doctoral students entering the program with an M.S. must complete a total of at least 30 graduate credits. The degree of Doctor of Philosophy is conferred in recognition of breadth of scholarly attainment and of demonstrated power to investigate problems independently and effectively, rather than for the completion of definite courses of study through a stated period of time.

Doctoral students in Entomology and Wildlife Ecology must complete the following courses or their equivalent for both concentrations, either before or during their program at Delaware:

ENWC 814	Advanced Ecology	3
ENWC 870	Graduate Research Seminar	0
ENWC 888	Topics in Entomology and Applied Ecology	0
6 credits of graduate statistics (600-level or above)		6
9 credits of Doctoral Dissertation (ENWC 969)		9

Doctoral students must satisfy the requirements of at least one of two concentrations, Entomology or Wildlife Ecology, by completing the following courses or their equivalent under the selected concentration, either before or during their program at Delaware.

Entomology Concentration

ENWC 605	Insect Structure and Function	4
ENWC 606	Insect ID—Taxonomy	3
One other three-credit graduate level course primarily on insects		3
(Obtain list from department office for qualified courses)		

Wildlife Ecology Concentration

Two of the following:

ENWC 615	Wildlife Research Techniques	3
ENWC 618	Ornithology	3
ENWC 620	Behavioral Ecology	3
ENWC 624	Herpetology	3
ENWC 625	Mammalogy	3
ENWC 635	Wildlife Population Dynamics	3
ENWC 655	Conservation Genetics	3

If any of the above course requirements are completed before starting the Ph.D. program, substitute courses counting toward the total minimum credits must be approved by the student’s graduate committee. Students entering with a B.S. must complete a total of at least 60 graduate credits while enrolled in the program. A maximum of 3 credits in ENWC 666, 668, 866, 868, and 9 credits of 969 can be applied to the doctoral degree.

Through their course of study, doctoral students should develop significant expertise in one major area and in at least one ancillary area. During the first semester of study, students should develop a proposed list of courses that they will complete while at Delaware. This course program should then be discussed, modified, and approved by the student’s graduate committee.

B. *Research Proposal*

By the end of the first year of graduate study, candidates must develop a preliminary research proposal describing the intended dissertation research. This preliminary proposal must be presented orally in a forum open to all members of the department. The student must complete ENWC 870, Graduate Research Seminar, to satisfy this requirement.

Doctoral students must also submit a written research proposal and have it accepted by their graduate committee. This proposal should include a detailed review of pertinent literature, justification for conducting the research, methods and procedures to be used, and a timetable for completion. Preliminary research results may also be included. The proposal should be submitted within 3 months of the oral proposal, and must be presented at a meeting of the student’s graduate committee. The proposal will be reviewed and refined as necessary, based on

the committee's input. If major emphasis is shifted during the course of the research, the proposal should be amended with the advice and consent of the committee.

C. Qualifying Examination

Doctoral students must prove to their graduate committee that they have acquired a comprehensive grasp of their field of study through a qualifying examination (written and oral) before they are admitted to formal Ph.D. candidacy. This examination should generally occur by the end of the second year of study. The examination shall include questions to evaluate basic competence in biology, ecology, and statistics as well as advanced knowledge in the designated major and ancillary areas. The examination areas, examiners for each of the areas, and pertinent review materials will be identified by the committee and communicated in writing by the major advisor to the student no later than the end of the second semester. In administering the examination, each member of the student's committee will submit written questions to be answered by the student in writing, under conditions to be established by the committee. Each committee member will read and grade the student's responses to their own written questions, prior to the oral portion of the exam. The oral portion will follow approximately 2 weeks after the end of the written portion, and will be conducted by the student's graduate committee. Decisions concerning passage of the examination and recommendations stemming from it are decided by the committee based on a simple majority vote. If the first attempt results in failure, the second examination cannot be taken earlier than 90 days nor later than 365 days following the first examination. The examination may be taken only twice. A second failure results in dismissal from the program. In the case of a second failure, a student has the option of completing all requirements for the Master of Science degree in either major provided that he or she does not already have that degree.

D. Admission to Candidacy

When they begin their program, all Ph.D. students are classified as pre-candidates (G1 status). The requirements for admission to doctoral candidacy (G2 status) are that the student has (1) had a program of study approved, (2) completed at least one academic year of full-time graduate study in residence at the University, (3) had a research project accepted by the graduate committee, and (4) passed the program's qualifying examination. The advisor must submit the recommendation for candidacy form to the Office of Graduate Studies.

E. Teaching Requirement

Doctoral candidates must provide evidence of a significant teaching experience during their program, for example by acting as a TA in charge of a laboratory section during an entire semester, by developing and delivering lectures and/or preparing laboratories for one module in an established course, or by developing and presenting a series of Extension workshops. This experience should be developed by the candidate in conjunction with the committee and its completion verified by a letter from the instructor of the course to the advisor with a copy to the Department Chair. The advisor should notify the Graduate Office when this requirement has been satisfied.

F. *Conference Presentation*

Doctoral candidates must make at least one presentation of a research paper at a regional or national conference during their program. Verification should be by letter from the advisor to the Department Chair, with a copy to the Graduate Office.

G. *Dissertation and Final Oral Examination*

After they have been formally admitted to candidacy, students must register for and complete nine credit hours of ENWC 969 (Doctoral Dissertation). Note that at this point the composition of the committee may be changed to more closely reflect the specific subject matter of the dissertation, as long as the committee still consists of four to six members with a minimum of three from within and one from outside the Department. The dissertation must present original research and must meet the generally accepted professional and literary standards for scholarship in the student's field. It must also adhere to the style requirements of the University of Delaware. Students are encouraged to write the dissertation in a style suitable for one or more (usually 2-3) manuscripts ready for submission to an appropriate journal. Upon completion, the dissertation must be presented in a formal, public seminar, followed by a final oral examination, consisting of a defense of the dissertation and a test of the candidate's mastery of the fields covered in the program. The final oral examination is conducted by the student's graduate committee, and is open to all University of Delaware faculty members. To permit adequate time for the committee to review the dissertation, all copies of the tentatively completed dissertation (subject to revisions required by the committee) must be delivered to committee members at least two weeks before the date of the final oral examination. The advisor must submit certification of a successful defense to the Office of Graduate Studies.

H. *Annual Evaluations*

Each doctoral student will be formally evaluated at the end of each academic year by the student's graduate committee. This written evaluation will provide students with detailed feedback on their progress toward the degree. The written evaluation will be part of the student's official record, and a copy must be submitted to the Department Chair.

FINANCIAL SUPPORT

A. *Assistantships and Fellowships*

Graduate students in good standing may receive financial support from a research assistantship, teaching assistantship or fellowship. Graduate students on an assistantship or fellowship are expected to give their full-time attention to graduate study and may not engage in any remunerative employment while holding the assistantship or fellowship.

1. Research Assistantships – Students work on faculty projects for 20 hours per week. An attempt is made to match faculty and student interests, but students should consider this an opportunity to develop competencies in new areas, if interests do not match. Assignments are made by the Chair, subject to the approval of the faculty member(s) directing the research

project. Students on research assistantship are expected to enroll in a minimum of 9 credits per semester until the course requirements for the degree are fulfilled. After completing the course requirements, students on research assistantship may enroll for a minimum of 6 credits or as sustaining.

2. Teaching Assistantships – Students assist in teaching undergraduate and/or graduate courses. Students may be expected to prepare and grade examinations under the supervision of the instructor, handle routine class administrative procedures, counsel and tutor individual students where necessary, and possibly conduct classes. In some cases, time is split between two or more courses, but in no case will the total workload exceed 20 hours per week. Students should view this as an opportunity to enhance their knowledge and to develop teaching skills at the college level. Assignments are made by the Chair, after consultation with faculty member(s) in charge of the course(s). Teaching Assistantships may be available in the Department of Entomology & Wildlife Ecology and in the Department of Biological Sciences. Students on a teaching assistantship must enroll for a minimum of 6 credits unless they have completed all degree course requirements whereupon they may register in sustaining status.

3. Fellowships – Department, College, or University Fellowships are usually reserved for students in the advanced stages of their graduate careers to support thesis and dissertation research and writing. Awards are recommended by the faculty and the Department Graduate Studies Committee and are made by the Chair. Students holding a fellowship must register for 9 credits each semester.

B. *Procedure for Nominating and Awarding Assistantships*

1. Application for fellowships, assistantships and scholarships – Students wishing to be considered for nomination for a fellowship or assistantship should so indicate on their application form for admission. Nominees must have a cumulative grade index of at least 2.8 (in undergraduate courses) for incoming students, or 3.0 (in graduate courses) for continuing students. Fellowships, assistantships, and scholarships become available at various times during the year. Students should inquire of the Department Chair concerning their availability.

2. Award of assistantships -- Graduate research assistantships, teaching assistantships and fellowships are awarded to qualified students by the Department. When possible, announcement of graduate research assistantship awards will be made by April 1 for fall semester and by November 1 for the spring semester. Students entering in the fall may begin working and receiving research assistantships in summer months. Other awards will be made by June 1 for the fall semester and Dec. 1 for the spring semester, when possible.

3. Retention of assistantships -- Awardees hold assistantships for one year. Assistantships will be reviewed by the end of April of the first year and evaluated for renewal. The review and evaluation for renewal of assistantships will be conducted by the Department Chair and the student's advisor. Review and evaluation of teaching assistantships should include input from the entire teaching staff. The Department Chair will initiate the review.

RESIDENCY AND TIME LIMITS

The University requires that the master's degree be completed within ten consecutive semesters. The doctoral degree must be completed within ten consecutive semesters for students admitted with a Master's degree and within fourteen consecutive semesters for students admitted without it. Full-time study is strongly encouraged. Students who can devote full time to their program should earn the master's degree within two to two and a half years, and the doctorate within three to four years. Students in the doctoral degree program must spend at least one continuous academic year in full-time study in the program.

EFFECTIVE DATE AND NOTIFICATION OF STUDENTS

The requirements and guidelines stated herein are in effect for students entering graduate status as of September 1, 2007. They shall apply to current students to the extent that they do not cause undue hardship. A student that matriculated prior to September 1, 2007, who wishes to change to a program under the requirements stated herein must submit the appropriate administrative request forms by December 20, 2007, to have the change of status approved.

All students applying for admission should receive this set of guidelines and information. Faculty advisors should be sure that each of their graduate student advisees has a copy of and is aware of these requirements. Copies are available in the department office. Students are responsible for being familiar with the University of Delaware Academic Regulations for Graduate Students published in the Graduate Catalog.

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APPENDIX B

Graduate Program Portion of the Academic Program Review of Entomology and Wildlife Ecology

Academic Review Department of Entomology and Wildlife Ecology November 11-13, 2007

Review team: Richard Casagrande (Chair, University of Rhode Island), Gary Felton (Penn State University), Eric Hellgren (Southern Illinois University), Peter Paton (University of Rhode Island) and Steven Skopik (University of Delaware).

The academic review of the Department of Entomology and Wildlife Ecology (ENWC) began on Sunday evening (11 November) with a dinner meeting that brought the Review Team together with Robin Morgan (Dean, College of Agriculture and Natural Resources), Havidán Rodríguez (Vice Provost/Academic Affairs and International Programs), Tom Sims (Associate Dean, College of Agriculture and Natural Resources) and the internal member of the Review Team, Steven Skopik (Biological Sciences). At this meeting, we decided on the Chair of the Review Team and discussed the scope of the review process. The upper administration is committed to developing and maintaining a high-quality program that will serve the needs of undergraduates and graduate students. They placed a strong emphasis on the research conducted by faculty in the department; thus, garnering external grants and publishing in high-impact journals is important. The mood of the upper administration was positive and the emphasis was on expanding the Department (at a minimum retaining the status quo). The Dean emphasized it was important to engage faculty in research that utilized the tools of molecular biology, and suggested that she would be supportive of position requests for new hires with a molecular emphasis. She also talked about maintaining the current two faculty lines that are unfilled due to retirements. She suggested that there was a strong possibility of an additional 1 or 2 faculty lines. It was our charge to help the Department focus on future directions with respect to the open positions and possibly new positions. The administration also sought a critical evaluation of the department, including advice on what should happen with extension lines. Finally, the Dean emphasized that hiring decisions for new faculty should be based on what type of research they conduct—not just what courses need to be taught.

On Monday, 12 November, we met with Department Chair (Dr. Doug Tallamy), and began a series of meetings with faculty, extension staff, external professionals, support staff, and undergraduate and undergraduate students before touring facilities. On Tuesday, we met with the vice provosts before an exit interview with the faculty and a concluding lunch with Dean Morgan, Vice Provost Rodríguez and Vice Provost Thoroughgood. Our schedule is appended to this report.

Competitiveness

ENWC is a unique department. To our knowledge, it is the only department in the United States that combines Entomology and Wildlife Conservation. Hence, we cannot identify other departments that would be useful for comparison or emulation. Within the department, faculty in the two disciplines form a very tight amalgam and it would be inappropriate to evaluate them separately. However, we can speak to the size of the component disciplines. The entomology group is small relative to other Land Grant institutions with a comparable agricultural economy

and similar student numbers. We might expect an entomology staff of 1.5 to 2 times this size. Similarly, the wildlife component of the department is about two positions short of what might be expected at comparable institutions, especially given the more regional (as opposed to state-specific) nature of the work of the wildlife faculty. Despite the size limitation, this department seems to be functioning at a very high level. The unique conglomeration of the two disciplines in ENWC is a strong asset that sets this department apart at a national level. It has clearly been a positive factor in the very successful recruitment of undergraduates and Master's students. Many of the students that were interviewed were very positive about the cross-disciplinary nature of the Department. From all indications the Departmental faculty work members exceptionally well together and are remarkably free from some of the territoriality that can take place when departments are formed from seemingly disparate departments. We suggest that a number of initiatives that are described below under the graduate program and under future hires will help continue to build upon the uniqueness of the Department and will help garner greater national recognition. With faculty replacements and the addition of 1-2 faculty lines to the department, we feel the Department will be able to maintain the critical mass necessary for a high-quality research program that will enhance the educational opportunities for undergraduate and graduate students.

Conservation biologists and wildlife managers are increasingly concerned about conserving a broader array of taxa, with much more emphasis placed on insects. In addition, it is important for wildlife biologists to be well grounded in their understanding of invertebrates. Thus the entomological courses required of Wildlife and Conservation Biology majors provide a unique strength that should make UD undergraduates more competitive on the job market. The same is true of entomology students who benefit from expanding their vision beyond the six-legged animals in the ecosystems.

Most faculty members are extremely productive and publish in high-impact journals. The Department's applied ecological research has garnered it a strong regional and national reputation, and as the careers of the young faculty members develop and new faculty are added to the Department, we expect the national and international reputation of the department to continue to grow.

Graduate Program

The department has been quite effective in attracting and maintaining a relatively large pool of quality graduate students. Most of the 20+ active graduate students are enrolled in the M.S. program, with 8 seeking the Ph.D. degree. These students, like their undergraduate colleagues, heaped high praise upon the department, its professors and programs. We agree. However, it was easier to pry suggestions out of the graduate students than it was for the undergraduates. We present the following for consideration:

- 1) There is an urgent need for one or more courses in applied statistics. Students were unanimous in requesting practical instruction that would have direct applicability in their research. Faculty members in this department and across campus had previously identified the same problem.
- 2) Graduate students would like to have more academic rigor than is generally available in courses that are cross-listed at 400 and 600 levels. With a strong undergraduate component in virtually all graduate courses, it is difficult to challenge the graduate students. This is particularly difficult for Ph.D. candidates. Faculty might consider dropping some 400-level cross listings, focusing on the graduate students and exceptional undergraduates that would take the

courses at the 600 level. Hiring additional faculty would facilitate offering more 800-level courses. We suggest that more 800-level graduate current topics seminars be offered with a faculty member helping to select readings and focus discussions. These seminar courses could be provided with relatively little effort by existing faculty – including adjuncts in the USDA Beneficial Insects Research Laboratory.

3) The graduate students seem to interact well and are known for off-campus socializing; however they would like to know more about the research in other laboratories within the department. They liked the idea of having a department coffee hour at least once weekly. The graduate students should consider establishing a graduate student organization and sending at least one representative to departmental faculty meetings.

4) The department has several world-class scientists who could attract Ph.D. candidates from throughout the country. Thus, we found it surprising that among the current cohort of Ph.D. students, all obtained their M.S. degrees in ENWC despite departmental policy of encouraging M.S. students (once graduated) to broaden their horizons and continue somewhere else. Perhaps with additional publicity via an improved departmental web site or more aggressive placement of advertisements for graduate assistantships, the department could attract Ph.D. candidates from greater distances.

5) The Ph.D. program in this department began in 1999, and has successfully graduated 3 students. A total of 8 students are currently in the program, which will be reviewed shortly. We recommend that, given the importance of a doctoral program in building a research enterprise and the promise shown during these first few years, the Ph.D. program in ENWC be renewed. Overall, the department appears to be very successful in training and placing graduate students.

Faculty and Staff

We were impressed by the faculty in ENWC and the esprit d'corps that they engender throughout the department. They are obviously devoted to their undergraduate and graduate students and they clearly provide a high-quality learning environment. Faculty members provide a family atmosphere, thus everyone gets along. As the staff stated, they “cannot imagine working for a better academic unit at UD”. It is highly unusual to have an academic department in which the faculty interacts so well and considerable efforts are warranted to maintain this relationship. The department might consider a communal coffee pot, brown bag lunches, departmental retreats, or other social events to maintain positive interactions.

There is currently only one female tenure-track faculty member in ENWC. Given the current gender bias in undergraduate ranks, it would be helpful to search for more female faculty mentors in the future. The faculty exhibits a bimodal distribution in the ranks of faculty members, with three Assistant Professors, one Associate Professor, and five Professors (two of whom are in the process of retiring). According to the Dean, 40% of the faculty at UD will retire in the next 5-10 years.

In general, the faculty demonstrates excellent scholarship, publishing regularly in leading academic journals in both entomology and wildlife ecology. Grant success has increased dramatically in recent years and shows all signs of continuing to improve. For example, the three wildlife faculty hired in the past seven years (two of them in the last four years), are all off to promising starts with productive graduate students, furnished labs, publications, and effective grantsmanship. As their programs mature, departmental research productivity will keep increasing. A few faculty members could put more effort into seeking external funding and publishing in high-impact journals. New hires will substantially boost departmental output of

grants and publications. Grant success also might be enhanced if faculty initiated more interdisciplinary grant proposals.

University Support

According to ENWC faculty, library facilities, computer support services, and facilities services generally meet their expectations.

Plans, Goals, and Resource Allocation

We are particularly excited about the concept of the Center for Managed Ecosystems. We urge the Dean to continue to seek funding for this center. We feel this center fits into the current mission of ENWC and would lead to useful collaboration on-campus and beyond.

Facilities.

The university is very fortunate to have the Woodlot and yet the faculty and students of ENWC are concerned that this facility might be lost to development. The site is a key and beloved field teaching laboratory for the entire department. It is also the site of the longest running population study of a Neotropical migratory bird (Wood Thrush) in the country and we are encouraged by the Dean's pledge that it will be maintained. We urge the Dean and the University to support, maintain, and sustain the Woodlot in perpetuity.

The department has attractive and functional facilities, but currently has a serious lack of storage and museum space. Storage space is not expensive and this need should be immediately addressed. However, the insect museum needs special ventilation. A short-term solution to museum space might be to move desks and sinks out of the current room and handle all specimens in an adjacent office or laboratory.

Faculty Positions.

The Department is one of the key departments at UD for environmental issues. More than other departments, ENWC has expertise on the application of conservation issues to protect local, regional, and national biodiversity. To maintain this role, it is imperative that retiring faculty be replaced. The department's research and graduate programs also could be greatly enhanced by additional faculty lines, which could dovetail nicely with university-wide plans to increase the total number of graduate students at UD. We suggest that the department consider four faculty positions (2 replacements, 2 new) all of which could fit under the umbrella of the Center for Managed Ecosystems. The aforementioned need for faculty diversity could be addressed through searches for these new hires, especially if university-wide hiring initiatives are available to provide resources from outside the College.

Restoration ecologist – We suggest that this key faculty line be filled at the Associate Professor level because we recommend this person become the Director of the new Center for Managed Ecosystems. In addition, we feel this Department needs some mid-level faculty to be mentors for the large number of existing and anticipated Assistant Professors.

Pollination ecologist - This Assistant Professor level position would specialize in non-native and native pollinators. Managed bees are vital to the production of more than 90 crops, and honey bees alone pollinate crops valued at over \$14 billion. However, two parasitic mites and colony collapse disorder are devastating beekeeping operations, driving production costs sharply higher and reducing the availability of honey bees for pollination. There is an urgent need for research to explain and manage honey bee decline as well as to identify other insect species that

could be used to pollinate crops. This position would be a replacement for Dr. Dewey Caron, but we suggest a three-way split, 50% research, 25% teaching, and 25% extension. Demonstrated experience with the use of molecular genetics techniques would be important in candidates for this position. There are ample opportunities for research funding in this area including NSF and a growing number of programs from USDA NRI.

Vector ecologist - This Assistant Professor level position would address diseases such as Lyme disease and West Nile Virus that are harbored among wildlife populations and transmitted to humans by insects. This interdisciplinary research is perfectly suited to the ENWC department. This field ecologist would use molecular techniques to characterize disease cycles and better understand the dynamics of virus transmission in natural foci. This knowledge would aid public health workers to develop effective surveillance programs and enhance vector management so as to minimize human infection with vector-borne diseases.

Conservation genetics – We suggest the hiring of an ecologist who uses molecular tools to address conservation and management issues. Given that one of the foci of the Center for Managed Ecosystems is the maintenance and enhancement of biodiversity, a fruitful area for this position may be to study genetic diversity and gene flow among fragmented habitats and via corridors within these systems. This position also could enhance the strong organismal programs in Entomology and Wildlife Ecology by adding a new set of tools for answering questions. Depending on the hire, funding could come from a variety of sources, including state and federal agencies, industry, and competitive grant programs.

We recommend that these positions be considered as a cluster hire under the umbrella of environmental issues and the proposed Center for Managed Ecosystems. The selection of the four positions will further strengthen the unique cross-disciplinary nature of the Department. Each faculty line will have the opportunity (and the responsibility) to further bridge the entomology and wildlife components of the Department. We recommend these positions be based upon the strong likelihood that each of the research areas will be well-funded from federal extramural grants. The disciplinary focus of each position is well-aligned with emerging (and continuing) issues in environmental sciences.

Further, the research areas of the positions will improve the education of undergraduates and graduate students by bringing new areas of expertise (e.g., genetics, molecular biology) into the Department. Finally, investment in these four positions will greatly enhance the national reputation of the Department. These faculty lines will place the Department in a very competitive position to recruit the best students, secure strong grant support and become a very strong regional force in Entomology and Wildlife Ecology. We believe the ENWC is poised to become a highly visible Department at the national level.