

Cover Sheet: Request 12772

ENY 4XXX Ecology and Conservation of Pollinators

Info

Process	Course New Ugrad/Pro
Status	Pending at PV - University Curriculum Committee (UCC)
Submitter	Rachel Mallinger rachel.mallinger@ufl.edu
Created	6/13/2018 1:28:50 PM
Updated	10/10/2018 4:45:36 PM
Description of request	Requesting a new undergraduate-level course to fill a current void in courses on pollination ecology, plant-pollinator interactions, and pollinator conservation. This new course will furthermore build research and communication skills, and science literacy, in undergraduate students.

Actions

Step	Status	Group	User	Comment	Updated
Department	Approved	CALS - Entomology and Nematology 514914000	Heather Mcauslane		7/2/2018
No document changes					
College	Approved	CALS - College of Agricultural and Life Sciences	Joel H Brendemuhl	Corrections requested by the CALS CC have been addressed. The graduate level course has also been approved and is pending at the GCC.	10/10/2018
Pollinator%20Ecology%20Syllabus_JHB edits.docx					10/10/2018
University Curriculum Committee	Pending	PV - University Curriculum Committee (UCC)			10/10/2018
No document changes					
Statewide Course Numbering System					
No document changes					
Office of the Registrar					
No document changes					
Student Academic Support System					
No document changes					
Catalog					
No document changes					
College Notified					
No document changes					

Course|New for request 12772

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Request: ENY 4XXX Ecology and Conservation of Pollinators

Description of request: Requesting a new undergraduate-level course to fill a current void in courses on pollination ecology, plant-pollinator interactions, and pollinator conservation. This new course will furthermore build research and communication skills, and science literacy, in undergraduate students.

Submitter: Joel H Brendemuhl brendj@ufl.edu

Created: 10/10/2018 4:43:57 PM

Form version: 6

Responses

Recommended Prefix

Enter the three letter code indicating placement of course within the discipline (e.g., POS, ATR, ENC). Note that for new course proposals, the State Common Numbering System (SCNS) may assign a different prefix.

Response:

ENY

Course Level

Select the one digit code preceding the course number that indicates the course level at which the course is taught (e.g., 1=freshman, 2=sophomore, etc.).

Response:

4

Number

Enter the three digit code indicating the specific content of the course based on the SCNS taxonomy and course equivalency profiles. For new course requests, this may be XXX until SCNS assigns an appropriate number.

Response:

XXX

Category of Instruction

Indicate whether the course is introductory, intermediate or advanced. Introductory courses are those that require no prerequisites and are general in nature. Intermediate courses require some prior preparation in a related area. Advanced courses require specific competencies or knowledge relevant to the topic prior to enrollment.

Response:

Joint (Ugrad/Grad)

- 1000 and 2000 level = Introductory undergraduate
- 3000 level = Intermediate undergraduate
- 4000 level = Advanced undergraduate
- 5000 level = Introductory graduate
- 6000 level = Intermediate graduate
- 7000 level = Advanced graduate

4000/5000 and 4000/6000 levels = Joint undergraduate/graduate (these must be approved by the UCC and the Graduate Council)

Lab Code

Enter the lab code to indicate whether the course is lecture only (None), lab only (L), or a combined lecture and lab (C).

Response:
None

Course Title

Enter the title of the course as it should appear in the Academic Catalog.

Response:
Ecology and Conservation of Pollinators

Transcript Title

Enter the title that will appear in the transcript and the schedule of courses. Note that this must be limited to 21 characters (including spaces and punctuation).

Response:
Eco Cons Pollinator

Degree Type

Select the type of degree program for which this course is intended.

Response:
Baccalaureate

Delivery Method(s)

Indicate all platforms through which the course is currently planned to be delivered.

Response:
On-Campus

Co-Listing

Will this course be jointly taught to undergraduate, graduate, and/or professional students?

Response:
Yes

Co-Listing Explanation

Please detail how coursework differs for undergraduate, graduate, and/or professional students. Additionally, please upload a copy of both the undergraduate and graduate syllabus to the request in .pdf format.

Response:
This course is a joint undergraduate and graduate level course; both graduate and undergraduate students will attend the same on-campus class periods. Graduate students will be expected to do an additional assignment (lead a class discussion on two scientific publications), a more rigorous assignment (longer and more in-depth research paper of 7-8 pages with 10 citations in

comparison to 4-5 pages with 3 citations for undergraduate student papers), and additional readings (for research paper and leading discussion).

Effective Term

Select the requested term that the course will first be offered. Selecting "Earliest" will allow the course to be active in the earliest term after SCNS approval. If a specific term and year are selected, this should reflect the department's best projection. Courses cannot be implemented retroactively, and therefore the actual effective term cannot be prior to SCNS approval, which must be obtained prior to the first day of classes for the effective term. SCNS approval typically requires 2 to 6 weeks after approval of the course at UF.

Response:
Spring

Effective Year

Select the requested year that the course will first be offered. See preceding item for further information.

Response:
Earliest Available

Rotating Topic?

Select "Yes" if the course can have rotating (varying) topics. These course titles can vary by topic in the Schedule of Courses.

Response:
No

Repeatable Credit?

Select "Yes" if the course may be repeated for credit. If the course will also have rotating topics, be sure to indicate this in the question above.

Response:
No

Amount of Credit

Select the number of credits awarded to the student upon successful completion, or select "Variable" if the course will be offered with variable credit and then indicate the minimum and maximum credits per section. Note that credit hours are regulated by Rule 6A-10.033, FAC. If you select "Variable" for the amount of credit, additional fields will appear in which to indicate the minimum and maximum number of total credits.

Response:
3

S/U Only?

Select "Yes" if all students should be graded as S/U in the course. Note that each course must be entered into the UF curriculum inventory as either letter-graded or S/U. A course may not have both options. However, letter-graded courses allow students to take the course S/U with instructor permission.

Response:

No

Contact Type

Select the best option to describe course contact type. This selection determines whether base hours or headcount hours will be used to determine the total contact hours per credit hour. Note that the headcount hour options are for courses that involve contact between the student and the professor on an individual basis.

Response:

Regularly Scheduled

- Regularly Scheduled [base hr]
- Thesis/Dissertation Supervision [1.0 headcount hr]
- Directed Individual Studies [0.5 headcount hr]
- Supervision of Student Interns [0.8 headcount hr]
- Supervision of Teaching/Research [0.5 headcount hr]
- Supervision of Cooperative Education [0.8 headcount hr]

Contact the Office of Institutional Planning and Research (352-392-0456) with questions regarding contact type.

Weekly Contact Hours

Indicate the number of hours instructors will have contact with students each week on average throughout the duration of the course.

Response:

3

Course Description

Provide a brief narrative description of the course content. This description will be published in the Academic Catalog and is limited to 50 words or fewer. See course description guidelines.

Response:

This course will examine interactions between animals and the plants that they pollinate, current threats to pollinator populations, and the conservation of pollinators worldwide. In this course, we will explore these topics through readings, discussion, and a field research project.

Prerequisites

Indicate all requirements that must be satisfied prior to enrollment in the course. Prerequisites will be automatically checked for each student attempting to register for the course. The prerequisite will be published in the Academic Catalog and must be formulated so that it can be enforced in the registration system. Please note that upper division courses (i.e., intermediate or advanced level of instruction) must have proper prerequisites to target the appropriate audience for the course.

Response:

(BSC 2010(C-) or equivalent) & (BSC 2010 L(C-) or equivalent) & (junior or senior standing)

Completing Prerequisites on UCC forms:

- Use "&" and "or" to conjoin multiple requirements; do not use commas, semicolons, etc.
- Use parentheses to specify groupings in multiple requirements.
- Specifying a course prerequisite (without specifying a grade) assumes the required passing grade is D-. In order to specify a different grade, include the grade in parentheses immediately after the course number. For example, "MAC 2311(B)" indicates that students are required to obtain a grade of B in Calculus I. MAC2311 by itself would only require a grade of D-.

- Specify all majors or minors included (if all majors in a college are acceptable the college code is sufficient).
- "Permission of department" is always an option so it should not be included in any prerequisite or co-requisite.

Example: A grade of C in HSC 3502, passing grades in HSC 3057 or HSC 4558, and major/minor in PHHP should be written as follows:

HSC 3502(C) & (HSC 3057 or HSC 4558) & (HP college or (HS or CMS or DSC or HP or RS minor))

Co-requisites

Indicate all requirements that must be taken concurrently with the course. Co-requisites are not checked by the registration system.

Response:

None

Rationale and Placement in Curriculum

Explain the rationale for offering the course and its place in the curriculum.

Response:

Currently, there are no undergraduate courses at UF on pollination ecology and pollinator conservation. These topics have recently received much attention due to concerns over pollinator population declines, honey bee colony losses, and inadequate crop pollination. This course will address this need by focusing on both the ecology of animal pollinators and the plants that they pollinate, as well as current threats to pollinators and conservation plans. Furthermore, this course will include an inquiry-based field research project, reading and discussing the primary literature, and scientific writing to build critical-thinking and communication skills in undergraduate students. This course will be offered as an elective within the Entomology & Nematology Department's curriculum.

Course Objectives

Describe the core knowledge and skills that student should derive from the course. The objectives should be both observable and measurable.

Response:

1. Describe the role of pollinators in both natural and agricultural systems, and the breadth of animal pollinator taxa
2. Explain basic concepts of pollination ecology and relate these concepts to observable phenomena in nature
3. Diagnose factors affecting pollinator populations today, and assess the consequences of pollinator declines for biodiversity and global food production.
4. Analyze, interpret and critique scientific literature
5. Develop and carry out a field-based research project
6. Communicate research in the form of a scientific paper and oral presentation

Course Textbook(s) and/or Other Assigned Reading

Enter the title, author(s) and publication date of textbooks and/or readings that will be assigned. Please provide specific examples to evaluate the course.

Response:

No textbook is required for this course. Readings for the course will be provided to students via the course website.

The following readings will be assigned for discussion, and a few additional readings will be selected by graduate students:

Aguilar-Rodríguez, P.A., G. M., Cristina, M., Krömer, T., García-Franco, J.G., Knauer, A., Kessler, M., 2014. First record of bat-pollination in the species-rich genus *Tillandsia* (Bromeliaceae). *Ann Bot* 113, 1047–1055. <https://doi.org/10.1093/aob/mcu031>

Cakmak, I., Sanderson, C., Blocker, T.D., Pham, L.L., Checotah, S., Norman, A.A., Harader-Pate, B.K., Reidenbaugh, R.T., Nenchev, P., Barthell, J.F., Wells, H., 2009. Different solutions by bees to a foraging problem. *Anim. Behav.* 77, 1273–1280. <https://doi.org/10.1016/j.anbehav.2009.01.032>

Camazine, S. 1993. The regulation of pollen foraging by honey bees: How foragers assess the colony's need for pollen. *Behav Ecol Sociobiol* 32: 265 – 272.

Goering, D. 2016. North Dakota Pollinator Plan. North Dakota Department of Agriculture. Bismarck, North Dakota.

Fenster, C.B., Reynolds, R.J., Williams, C.W., Makowsky, R., Dudash, M.R. 2015. Quantifying hummingbird preference for floral trait combinations: The role of selection on trait interactions in the evolution of pollination syndromes. *Evolution* 69, 1113–1127. <https://doi.org/10.1111/evo.12639>

Herbertsson, L., Lindström, S.A.M., Rundlöf, M., Bommarco, R., Smith, H.G. 2016. Competition between managed honeybees and wild bumblebees depends on landscape context. *Basic and Applied Ecology*. <https://doi.org/10.1016/j.baae.2016.05.001>

Kearns, C.A., Inouye, D.W., 1993. *Techniques for pollination biologists*. University Press of Colorado.

Klein, A.M., Vaissiere, B.E., Cane, J.H., Steffan-Dewenter, I., Cunningham, S.A., Kremen, C., Tscharntke, T., 2007. Importance of pollinators in changing landscapes for world crops. *Proceedings of the Royal Society B-Biological Sciences* 274, 303–313.

Knauer, A.C., Schiestl, F.P., 2015. Bees use honest floral signals as indicators of reward when visiting flowers. *Ecology Letters* 18, 135–143. <https://doi.org/10.1111/ele.12386>

Krauss, J., Steffan-Dewenter, I., Tscharntke, T. 2003. How does landscape context contribute to effects of habitat fragmentation on diversity and population density of butterflies? *Journal of Biogeography* 30, 889–900. <https://doi.org/10.1046/j.1365-2699.2003.00878.x>

Kremen, C., M'Gonigle, L.K., 2015. EDITOR'S CHOICE: Small-scale restoration in intensive agricultural landscapes supports more specialized and less mobile pollinator species. *J Appl Ecol* 52, 602–610. <https://doi.org/10.1111/1365-2664.12418>

Kudo, G., Ida, T.Y., 2013. Early onset of spring increases the phenological mismatch between plants and pollinators. *Ecology* 94, 2311–2320. <https://doi.org/10.1890/12-2003.1>

Locke, C., Meils, E., Murray, M. 2016. *The Wisconsin Pollinator Protection Plan*. Wisconsin Department of Agriculture, Trade, and Consumer Protection. Madison, WI.

Memmott, J., 1999. The structure of a plant-pollinator food web. *Ecology Letters* 2, 276–280. <https://doi.org/10.1046/j.1461-0248.1999.00087.x>

Rader, R., Bartomeus, I., Garibaldi, L.A., Garratt, M.P.D., Howlett, B.G., Winfree, R., Cunningham, S.A., Mayfield, M.M., Arthur, A.D., Andersson, G.K.S., Bommarco, R., Brittain, C., Carvalheiro, L.G., Chacoff, N.P., Entling, M.H., Foully, B., Freitas, B.M., Gemmill-Herren, B., Ghazoul, J., Griffin, S.R., Gross, C.L., Herbertsson, L., Herzog, F., Hipólito, J., Jaggard, S., Jauker, F., Klein, A.-M., Kleijn, D., Krishnan, S., Lemos, C.Q., Lindström, S.A.M., Mandelik, Y., Monteiro, V.M., Nelson, W., Nilsson, L., Pattermore, D.E., de O. Pereira, N., Pisanty, G., Potts, S.G., Reemer, M., Rundlöf, M., Sheffield, C.S., Scheper, J., Schüepp, C., Smith, H.G., Stanley, D.A., Stout, J.C., Szentgyörgyi, H., Taki, H., Vergara, C.H., Viana, B.F., Woyciechowski, M., 2015. Non-bee insects are important contributors to global crop pollination. *Proceedings of the National Academy of Sciences* 201517092. <https://doi.org/10.1073/pnas.1517092112>

Rundlöf, M., Andersson, G.K.S., Bommarco, R., Fries, I., Hederström, V., Herbertsson, L., Jonsson, O., Klatt, B.K., Pedersen, T.R., Yourstone, J., Smith, H.G., 2015. Seed coating with a neonicotinoid insecticide negatively affects wild bees. *Nature* 521, 77–80. <https://doi.org/10.1038/nature14420>

Sakata, Y., Nakahama, N. 2018. Flexible pollination system in an unpalatable shrub *Daphne miyabeana* (Thymelaeaceae). *Plant Species Biology* <https://doi.org/10.1111/1442-1984.12212>

Singh, R., Levitt, A.L., Rajotte, E.G., Holmes, E.C., Ostiguy, N., vanEngelsdorp, D., Lipkin, W.I., dePamphilis, C.W., Toth, A.L., Cox-Foster, D.L., 2010. RNA Viruses in Hymenopteran Pollinators: Evidence of Inter-Taxa Virus Transmission via Pollen and Potential Impact on Non-Apis Hymenopteran Species. *PLoS ONE* 5, e14357. <https://doi.org/10.1371/journal.pone.0014357>

Steffan-Dewenter, I., Munzenberg, U., Burger, C., Thies, C., Tscharntke, T., 2002. Scale-dependent effects of landscape context on three pollinator guilds. *Ecology* 83, 1421–1432.

Wilson, J.S., Carril, O.J.M., 2015. *The Bees in Your Backyard: A Guide to North America's Bees*. Princeton University Press, Princeton.

Winfree, R., Aguilar, R., Vázquez, D.P., LeBuhn, G., Aizen, M.A., 2009. A meta-analysis of bees' responses to anthropogenic disturbance. *Ecology* 90, 2068–2076. <https://doi.org/10.1890/08-1245.1>

Weekly Schedule of Topics

Provide a projected weekly schedule of topics. This should have sufficient detail to evaluate how the course would meet current curricular needs and the extent to which it overlaps with existing courses at UF.

Response:

Week 1: Plants: plant reproduction

Week 2: Pollinators: Bees, other insects, other animals

Week 3: Pollinator behavior: foraging theory, learning

Week 4: Plant-pollinator interactions: Co-evolution, pollination syndromes, networks

Week 5: Plant-pollinator interactions continued, crop pollination requirements

Week 6: Research methods and midterm

Week 7: Introduction to pollinator declines and conservation, student presentations

Week 8: Student Presentations

Week 9: Spring break

Week 10: Pollinator stressors: land-use change and pesticides

Week 11: Pollinator stressors: diseases **visit sites for research projects

Week 12: Pollinator stressors: climate change, invasive species, managed bees ** data collection and organizing

Week 13: data collection outside in groups

Week 14: Pollinator conservation: conservation plans **analyzing plant-pollinator data: statistics, graphs, and tables

Week 15: Pollinator conservation: habitat restoration, pollinator plantings, integrated crop pollination ** paper peer-review in pairs

Week 16: Papers due, flexible time, reading day

Finals week: Course wrap-up

Links and Policies

Consult the syllabus policy page for a list of required and recommended links to add to the syllabus. Please list the links and any additional policies that will be added to the course syllabus.

Please see: syllabus.ufl.edu for more information

Response:

Attendance and Make-Up Work

Requirements for class attendance and make-up exams, assignments and other work are consistent with university policies that can be found at:
<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>.

Online Course Evaluation Process

Student assessment of instruction is an important part of efforts to improve teaching and learning. At the end of the semester, students are expected to provide feedback on the quality of instruction in this course using a standard set of university and college criteria. These evaluations are conducted online at <https://evaluations.ufl.edu>. Evaluations are typically open for students to complete during the last two or three weeks of the semester; students will be notified of the specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results>.

Academic Honesty

As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge: "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity." You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment."

It is assumed that you will complete all work independently in each course unless the instructor provides explicit permission for you to collaborate on course tasks (e.g. assignments, papers, quizzes, exams). Furthermore, as part of your obligation to uphold the Honor Code, you should report any condition that facilitates academic misconduct to appropriate personnel. It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated. Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For more information regarding the Student Honor Code, please see: <http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code>.

Software Use:

All faculty, staff and students of the university are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against university policies and rules, disciplinary action will be taken as appropriate.

Services for Students with Disabilities

The Disability Resource Center coordinates the needed accommodations of students with disabilities. This includes registering disabilities, recommending academic accommodations within the classroom, accessing special adaptive computer equipment, providing interpretation services and mediating faculty-student disability related issues. Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation

0001 Reid Hall, 352-392-8565, www.dso.ufl.edu/drc/

Campus Helping Resources

Students experiencing crises or personal problems that interfere with their general well-being are encouraged to utilize the university's counseling resources. The Counseling & Wellness Center provides confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance.

- University Counseling & Wellness Center, 3190 Radio Road, 352-392-1575, www.counseling.ufl.edu/cwc/
- Counseling Services
- Groups and Workshops
- Outreach and Consultation

- Self-Help Library
- Wellness Coaching
- U Matter We Care, www.umatter.ufl.edu/
- Career Connections Center, First Floor JWRU, 392-1601, <https://career.ufl.edu/>.

Student Complaints

- Residential Course: <https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>.
- Online Course: <http://www.distance.ufl.edu/student-complaint-process>

Grading Scheme

List the types of assessments, assignments and other activities that will be used to determine the course grade, and the percentage contribution from each. This list should have sufficient detail to evaluate the course rigor and grade integrity. Include details about the grading rubric and percentage breakdowns for determining grades.

Response:

Grades and assignments:

This course is a joint undergraduate and graduate level course; both graduate and undergraduate students will attend the same on-campus class periods. Graduate students will be expected to do an additional assignment (lead discussion), a more rigorous assignment (longer and more in-depth research paper), and additional readings (for research paper and discussion) as further outlined below.

	Undergraduate (500 points total)	Graduate (550 points total)
participation	50 pts	50 pts
quizzes (8)	80 pts	80 pts
leading discussion	NA	50 pts
research project paper	120 pts	120 pts
paper peer-review	25 pts	25 pts
presentation on pollinator/plant conservation		100 pts
midterm exam	125 pts	125 pts

Participation: Grades for participation will be based on in-class activities including short in-class assignments as well as on participation in class discussions of the assigned readings.

Quizzes: There will be 10 unannounced quizzes throughout the semester that will cover the assigned readings for each day, and will take place at the beginning of class prior to discussion or lecture. Your lowest 2 quizzes for the semester will be dropped, and your grade for this component will be based on the best 8 of 10 quizzes.

Leading discussion: Graduate students will lead discussion on scientific papers assigned throughout the semester. Graduate students will be responsible for selecting a second reading to complement the assigned reading listed in the syllabus. Selected papers must be emailed to me at least 1 week prior to the scheduled discussion for approval and dissemination to the rest of the class. On the day of discussion, graduate students leading the discussion will turn in a list of discussion questions that they have prepared for class.

Presentation: Each student will present on a selected pollinator or plant. Presentations should be approximately 10 minutes long and cover the general biology, ecology, and geography of the pollinator or plant, as well as the conservation status or threats to current populations of the pollinator/plant.

Research project paper: In groups of four, you will be generating a research question and carrying out a field lab related to some aspect of pollination biology or pollinator ecology. We will learn about research methods and visit sites near Steinmetz Hall for data collection, followed by time in class to work as groups and collect data. Students may have to collect additional data outside of class time. While projects will be conducted in groups of four, students must write up individual papers in the format of a scientific manuscript including an introduction, methods, results, and discussion. Paper drafts will be peer-reviewed in student pairs prior to the due date, and your

review of a classmate's paper will account for 25 points of your total course grade. Undergraduate student papers should be 4-5 pages in length, excluding any tables, figures, or references list, with a minimum of 3 scientific references, while graduate student papers should be 7-8 pages in length, excluding any tables, figures, or references list, with a minimum of 10 scientific references. Additional criteria and writing tips will be distributed in class.

Grade distribution:

Grade	Points (undergraduate)	Points (graduate)	Percentages
A	470 - 500	517 - 550	94.0 - 100
A-	450 - 469.99	495 - 516.99	90.0 - 93.99
B+	430 - 449.99	473 - 494.99	86.0 - 89.99
B	415 - 429.99	456.5 - 472.99	83.0 - 85.99
B-	400 - 414.99	440 - 456.49	80.0 - 82.99
C+	380 - 399.99	418 - 439.99	76.0 - 79.99
C	365 - 379.99	401.5 - 417.99	73.0 - 75.99
C-	350 - 364.99	385 - 401.49	70.0 - 72.99
D+	330 - 349.99	363 - 384.99	66.0 - 69.99
D	315 - 329.99	346.5 - 362.99	63.0 - 65.99
D-	300 - 314.99	330 - 346.49	60.0 - 62.99
E	299.99 and below	329.99 and below	59.99 and below

Grades and Grade Points

For information on current UF policies for assigning grade points, see <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Instructor(s)

Enter the name of the planned instructor or instructors, or "to be determined" if instructors are not yet identified.

Response:

Rachel Mallinger

4XXX/6XXX: Ecology and Conservation of Pollinators, 3 credits

Meeting day and time: TBD

Instructor: Dr. Rachel Mallinger

2110 Steinmetz Hall

rachel.mallinger@ufl.edu

352-273-3962

Office Hours: TBD, 2110 Steinmetz Hall

Course Description: This course will examine interactions between animals and the plants that they pollinate, current threats to pollinator populations, and the conservation of pollinators worldwide. In this course, we will explore these topics through readings, discussion, and a field research project.

Course Background: Welcome to Ecology and Conservation of Pollinators! Pollinators are keystone species in both natural and agricultural habitats, responsible for the reproduction of an estimated 87.5% of flowering plants including many crops. In recent years, documented declines in some pollinator species have heightened awareness of pollinator conservation. In the first half of this course, we will explore the fascinating world of pollination ecology, including plant-pollinator interactions, co-evolution, and pollinator foraging behaviors. In the second half of the class, we will discuss the conservation status of pollinators, including stressors such as climate change, land-use change, pesticides, and pathogens. Students will conduct an inquiry-based field research project on pollinator ecology, and will additionally present to the class on a selected pollinator or plant.

Prerequisites: BSC 2010 and 2010 L, with a grade of C- or higher, or equivalent, and junior or senior standing, or instructor permission.

College-level general biology is required; a course in botany (e.g. BOT 2010C), ecology (e.g. PCB 4043C) or entomology (ENY 3005) is encouraged but not required.

Learning Objectives: By the end of the class, all students will be able to:

1. Describe the role of pollinators in both natural and agricultural systems, and the breadth of animal pollinator taxa.
2. Explain basic concepts of pollination ecology and relate these concepts to observable phenomena in nature.
3. Diagnose factors affecting pollinator populations today, and assess the consequences of pollinator declines for biodiversity and global food production.
4. Analyze, interpret and critique scientific literature.
5. Develop and carry out a field-based research project.
6. Communicate research in the form of a scientific paper and oral presentation.

Additionally, graduate students will be able to:

1. Facilitate classroom discussions

2. Search and evaluate the scientific literature, and assess papers for their importance and relevance to selected topics

Required materials: No textbook is required for this course. Readings for the course will be provided to students via the course website in Canvas.

Grades and assignments:

This course is a joint undergraduate and graduate level course; both graduate and undergraduate students will attend the same on-campus class periods. Graduate students will be expected to do an additional assignment (lead discussion), a more rigorous assignment (longer and more in-depth research paper), and additional readings (for research paper and discussion) as further outlined below.

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midterm exam	125 pts	125 pts

Participation: Grades for participation will be based on in-class activities including short in-class assignments as well as on participation in class discussions of the assigned readings.

Quizzes: There will be 10 unannounced quizzes throughout the semester that will cover the assigned readings for each day, and will take place at the beginning of class prior to discussion or lecture. Your lowest 2 quizzes for the semester will be dropped, and your grade for this component will be based on the best 8 of 10 quizzes.

Leading discussion: Graduate students will lead discussion on scientific papers assigned throughout the semester. Graduate students will be responsible for **selecting a second reading** to complement the assigned reading listed in the syllabus. Selected papers must be emailed to me at least 1 week prior to the scheduled discussion for approval and dissemination to the rest of the class. On the day of discussion, graduate students leading the discussion will turn in a list of discussion questions that they have prepared for class.

Presentation: Each student will present on a selected pollinator or plant. Presentations should be approximately 10 minutes long and cover the general biology, ecology, and geography of the pollinator or plant, as well as the conservation status or threats to current populations of the pollinator/plant.

Research project paper: In groups of four, you will be generating a research question and carrying out a field lab related to some aspect of pollination biology or pollinator ecology. We

will learn about research methods and visit sites near Steinmetz Hall for data collection, followed by time in class to work as groups and collect data. Students may have to collect additional data outside of class time. While projects will be conducted in groups of four, students must write up **individual papers** in the format of a scientific manuscript including an introduction, methods, results, and discussion. Paper drafts will be peer-reviewed in student pairs prior to the due date, and your review of a classmate's paper will account for 25 points of your total course grade. Undergraduate student papers should be 4-5 pages in length, excluding any tables, figures, or references list, with a minimum of 3 scientific references, while graduate student papers should be 7-8 pages in length, excluding any tables, figures, or references list, with a minimum of 10 scientific references. Additional criteria and writing tips will be distributed in class.

Grade distribution:

Grade	Points (undergraduate)	Points (graduate)	Percentages
A	470 - 500	517 - 550	94.0 - 100
A-	450 - 469.99	495 - 516.99	90.0 - 93.99
B+	430 - 449.99	473 - 494.99	86.0 - 89.99
B	415 - 429.99	456.5 - 472.99	83.0 - 85.99
B-	400 - 414.99	440 - 456.49	80.0 - 82.99
C+	380 - 399.99	418 - 439.99	76.0 - 79.99
C	365 - 379.99	401.5 - 417.99	73.0 - 75.99
C-	350 - 364.99	385 - 401.49	70.0 - 72.99
D+	330 - 349.99	363 - 384.99	66.0 - 69.99
D	315 - 329.99	346.5 - 362.99	63.0 - 65.99
D-	300 - 314.99	330 - 346.49	60.0 - 62.99
E	299.99 and below	329.99 and below	59.99 and below

Grades and Grade Points

For information on current UF policies for assigning grade points, see <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Course schedule and due dates:

<u>Week</u>	<u>Date</u>	<u>Topic</u>	<u>Reading</u>	<u>Assignments due and important notes</u>
1	Jan 8 - T	Course introduction		
1	Jan 10 - Th	Plants: reproduction and pollination	Sakata and Nakahama 2018	discussion (instructor-led)
2	Jan 15 - T	Pollinators: Bees	Sections from Wilson and Carril 2015	
2	Jan 17 - Th	Pollinators: Other insects and non-insect animals	Rader et al. 2015; Aguilar-Rodriguez et al. 2015	discussion
3	Jan 22 - T	Pollinator behavior: foraging theory	Cakmak et al. 2009	

3	Jan 24 - Th	Pollinator behavior: floral cues and learning	Knauer and Schiestl 2015	discussion
4	Jan 29 - T	Pollinator behavior: social insects and behavior at colony level	Camazine 1993	
4	Jan 31 - Th	Plant-pollinator interactions: Coevolution and pollination syndromes	Fenster et al. 2015	discussion
5	Feb 5 - T	Plant-pollinator interactions: networks, specialization, flexible foraging	Memmott 1999	
5	Feb 7 - Th	Crop pollination: pollinator-dependent crops and managed pollinators	Klein et al. 2007	discussion
6	Feb 12 - T	Research methods: plants and pollinators.	selected sections from Kearns and Inouye 1993	
6	Feb 14 - Th	Midterm		Midterm
7	Feb 19 - T	Introduction to pollinator declines and conservation	Winfree et al. 2009	discussion
7	Feb 21 - Th	Presentations		
8	Feb 26 - T	Presentations		
8	Feb 28 - Th	Presentations		
9	Spring break			
10	March 12 - T	Pollinator stressors: land-use change	Steffan-Dewenter et al. 2002; Krauss et al. 2003	discussion
10	March 14 - Th	Pollinator stressors: pesticides **Research group formation	Rundlof et al. 2015	discussion, time in groups for research planning
11	March 19 - T	Pollinator stressors: pathogens	Singh et al. 2010	discussion
11	March 21 - Th	visit sites around campus for research project		outside
12	March 26 - T	lecture on data collection and organization **time for project planning in groups		Research project outline due at end of class
12	March 28 - Th	Pollinator stressors: climate change, invasive species, managed bees	Kudo and Ida 2013; Herbertsson et al. 2016	discussion
13	April 2 - T	data collection in groups		outside
13	April 4 - Th	data collection in groups		outside
14	April 9 - T	Pollinator conservation: conservation plans (back-up data collection day)	excerpts from Wisconsin and North Dakota Pollinator Protection Plans	
14	April 11 - Th	Analyzing plant-pollinator data: statistics, tables, and graphs ** time for working in groups on analyzing data		
15	April 16 - T	Pollinator conservation: habitat restoration, pollinator plantings	Kremen and M'Gonigle 2015	discussion paper rough drafts due for peer-review

15	April 18 – Th	Pollinator conservation: integrated crop pollination ** paper peer-review in student pairs		peer review forms due at end of class
16	April 23 - T	Flex day		Research papers due
16	April 25 - Th	Reading day		
finals week		Course wrap-up		

Full reading list

- Aguilar-Rodríguez, P.A., G, M., Cristina, M., Krömer, T., García-Franco, J.G., Knauer, A., Kessler, M., 2014. First record of bat-pollination in the species-rich genus *Tillandsia* (Bromeliaceae). *Ann Bot* 113, 1047–1055. <https://doi.org/10.1093/aob/mcu031>
- Cakmak, I., Sanderson, C., Blocker, T.D., Pham, L.L., Checotah, S., Norman, A.A., Harader-Pate, B.K., Reidenbaugh, R.T., Nanchev, P., Barthell, J.F., Wells, H., 2009. Different solutions by bees to a foraging problem. *Anim. Behav.* 77, 1273–1280. <https://doi.org/10.1016/j.anbehav.2009.01.032>
- Camazine, S. 1993. The regulation of pollen foraging by honey bees: How foragers assess the colony's need for pollen. *Behav Ecol Sociobiol* 32: 265 – 272.
- Goering, D. 2016. North Dakota Pollinator Plan. North Dakota Department of Agriculture. Bismarck, North Dakota.
- Fenster, C.B., Reynolds, R.J., Williams, C.W., Makowsky, R., Dudash, M.R. 2015. Quantifying hummingbird preference for floral trait combinations: The role of selection on trait interactions in the evolution of pollination syndromes. *Evolution* 69, 1113–1127. <https://doi.org/10.1111/evo.12639>
- Herbertsson, L., Lindström, S.A.M., Rundlöf, M., Bommarco, R., Smith, H.G. 2016. Competition between managed honeybees and wild bumblebees depends on landscape context. *Basic and Applied Ecology*. <https://doi.org/10.1016/j.baae.2016.05.001>
- Kearns, C.A., Inouye, D.W., 1993. *Techniques for pollination biologists*. University Press of Colorado.
- Klein, A.M., Vaissiere, B.E., Cane, J.H., Steffan-Dewenter, I., Cunningham, S.A., Kremen, C., Tschamtkke, T., 2007. Importance of pollinators in changing landscapes for world crops. *Proceedings of the Royal Society B-Biological Sciences* 274, 303–313.
- Knauer, A.C., Schiestl, F.P., 2015. Bees use honest floral signals as indicators of reward when visiting flowers. *Ecology Letters* 18, 135–143. <https://doi.org/10.1111/ele.12386>
- Krauss, J., Steffan-Dewenter, I., Tschamtkke, T. 2003. How does landscape context contribute to effects of habitat fragmentation on diversity and population density of butterflies? *Journal of Biogeography* 30, 889–900. <https://doi.org/10.1046/j.1365-2699.2003.00878.x>
- Kremen, C., M'Gonigle, L.K., 2015. EDITOR'S CHOICE: Small-scale restoration in intensive agricultural landscapes supports more specialized and less mobile pollinator species. *J Appl Ecol* 52, 602–610. <https://doi.org/10.1111/1365-2664.12418>
- Kudo, G., Ida, T.Y., 2013. Early onset of spring increases the phenological mismatch between plants and pollinators. *Ecology* 94, 2311–2320. <https://doi.org/10.1890/12-2003.1>

- Locke, C., Meils, E., Murray, M. 2016. The Wisconsin Pollinator Protection Plan. Wisconsin Department of Agriculture, Trade, and Consumer Protection. Madison, WI.
- Memcott, J., 1999. The structure of a plant-pollinator food web. *Ecology Letters* 2, 276–280. <https://doi.org/10.1046/j.1461-0248.1999.00087.x>
- Rader, R., Bartomeus, I., Garibaldi, L.A., Garratt, M.P.D., Howlett, B.G., Winfree, R., Cunningham, S.A., Mayfield, M.M., Arthur, A.D., Andersson, G.K.S., Bommarco, R., Brittain, C., Carvalheiro, L.G., Chacoff, N.P., Entling, M.H., Foully, B., Freitas, B.M., Gemmill-Herren, B., Ghazoul, J., Griffin, S.R., Gross, C.L., Herbertsson, L., Herzog, F., Hipólito, J., Jaggar, S., Jauker, F., Klein, A.-M., Kleijn, D., Krishnan, S., Lemos, C.Q., Lindström, S.A.M., Mandelik, Y., Monteiro, V.M., Nelson, W., Nilsson, L., Pattermore, D.E., de O. Pereira, N., Pisanty, G., Potts, S.G., Reemer, M., Rundlöf, M., Sheffield, C.S., Scheper, J., Schüepp, C., Smith, H.G., Stanley, D.A., Stout, J.C., Szentgyörgyi, H., Taki, H., Vergara, C.H., Viana, B.F., Woyciechowski, M., 2015. Non-bee insects are important contributors to global crop pollination. *Proceedings of the National Academy of Sciences* 201517092. <https://doi.org/10.1073/pnas.1517092112>
- Rundlöf, M., Andersson, G.K.S., Bommarco, R., Fries, I., Hederström, V., Herbertsson, L., Jonsson, O., Klatt, B.K., Pedersen, T.R., Yourstone, J., Smith, H.G., 2015. Seed coating with a neonicotinoid insecticide negatively affects wild bees. *Nature* 521, 77–80. <https://doi.org/10.1038/nature14420>
- Sakata, Y., Nakahama, N. 2018. Flexible pollination system in an unpalatable shrub *Daphne miyabeana* (Thymelaeaceae). *Plant Species Biology* <https://doi.org/10.1111/1442-1984.12212>
- Singh, R., Levitt, A.L., Rajotte, E.G., Holmes, E.C., Ostiguy, N., vanEngelsdorp, D., Lipkin, W.I., dePamphilis, C.W., Toth, A.L., Cox-Foster, D.L., 2010. RNA Viruses in Hymenopteran Pollinators: Evidence of Inter-Taxa Virus Transmission via Pollen and Potential Impact on Non-Apis Hymenopteran Species. *PLoS ONE* 5, e14357. <https://doi.org/10.1371/journal.pone.0014357>
- Steffan-Dewenter, I., Munzenberg, U., Burger, C., Thies, C., Tschardt, T., 2002. Scale-dependent effects of landscape context on three pollinator guilds. *Ecology* 83, 1421–1432.
- Wilson, J.S., Carril, O.J.M., 2015. *The Bees in Your Backyard: A Guide to North America's Bees*. Princeton University Press, Princeton.
- Winfree, R., Aguilar, R., Vázquez, D.P., LeBuhn, G., Aizen, M.A., 2009. A meta-analysis of bees' responses to anthropogenic disturbance. *Ecology* 90, 2068–2076. <https://doi.org/10.1890/08-1245.1>

Attendance and Make-Up Work

Requirements for class attendance and make-up exams, assignments and other work are consistent with university policies that can be found at: <https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>.

Online Course Evaluation Process

Student assessment of instruction is an important part of efforts to improve teaching and learning. At the end of the semester, students are expected to provide feedback on the quality of instruction in this course using a standard set of university and college criteria. These evaluations are conducted online at <https://evaluations.ufl.edu>. Evaluations are typically open for students to complete during the last two or three weeks of the semester; students will be notified of the specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results>.

Academic Honesty

As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge: *“We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity.”* You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit at the University of Florida, the following pledge is either required or implied: *“On my honor, I have neither given nor received unauthorized aid in doing this assignment.”*

It is assumed that you will complete all work independently in each course unless the instructor provides explicit permission for you to collaborate on course tasks (e.g. assignments, papers, quizzes, exams). Furthermore, as part of your obligation to uphold the Honor Code, you should report any condition that facilitates academic misconduct to appropriate personnel. It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated. Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For more information regarding the Student Honor Code, please see: <http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code>.

Software Use

All faculty, staff and students of the university are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against university policies and rules, disciplinary action will be taken as appropriate.

Services for Students with Disabilities

The Disability Resource Center coordinates the needed accommodations of students with disabilities. This includes registering disabilities, recommending academic accommodations within the classroom, accessing special adaptive computer equipment, providing interpretation services and mediating faculty-student disability related issues. Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation

0001 Reid Hall, 352-392-8565, www.dso.ufl.edu/drc/

Campus Helping Resources

Students experiencing crises or personal problems that interfere with their general well-being are encouraged to utilize the university’s counseling resources. The Counseling & Wellness Center provides confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance.

- *University Counseling & Wellness Center, 3190 Radio Road, 352-392-1575,*

www.counseling.ufl.edu/cwc/

Counseling Services

Groups and Workshops

Outreach and Consultation

Self-Help Library

Wellness Coaching

- U Matter We Care, www.umatter.ufl.edu/
- *Career Connections Center, First Floor JWRU, 392-1601, <https://career.ufl.edu/>.*

Student Complaints

- Residential Course: <https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>.
- Online Course: <http://www.distance.ufl.edu/student-complaint-process>