

# SYLLABUS

## **Plant Diversity and Evolution (11:216:411) {undergraduate, 3 credits} & Plant Systematics (16:215:507) {graduate, 3 credits}**

### **Instructor**

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Office hours by appointment

### **Teaching assistant**

TBD

### **Short course description**

This class explores the origin and diversification of land plants, especially flowering plants with ethnobotanical uses. Topics include plant identification and nomenclature, botanical accuracy of medicinal plants, edible and toxic plants, evolutionary biosprospecting, reproductive biology of plants, and phylogenetics. Class includes fieldtrips, hands-on and independent projects, use of online tools, and class discussions.

### **INTRODUCTION**

The evolution and diversification of land plants have shaped life on Earth both in past times and today and are crucial for the survival of terrestrial ecosystems and the human species. Plants provide most of humanity's food, nutrients, and many medicines. Plant diversity is also crucial for well-functioning natural ecosystems, for improving public health, and long-term sustainability of both natural and urban systems. This class is about how our plant diversity of over a quarter million species has evolved over the last 500 million years, including various crop species since the origin of agriculture, and how the evolution of plant properties have provided crops, spices, horticultural plants, bioenergy, medicines and other chemicals, timber, etc. The class includes developing skills in plant identification (including toxic and edible plants, DNA barcoding of medicinal plants), phylogenetics, and morphological, anatomical and phytochemical evolution. Digital and online tools and resources will be strongly emphasized in working on real world problems such as estimates of biodiversity, taxonomic databases an accuracy in botanical names, identification of unknown plants (edible, toxic, wild, invasive), and biodocumentation and biosprospecting strategies for potential medicinal plants worldwide.

### **LEARNING GOALS**

Plant diversity and evolution focus on green plants from around the world. You will learn:

1. How plant diversity is discovered, described, and classified.
2. The history of land plants through time
3. The major features and evolutionary diversifications of vascular plants group.
4. "Vocabulary" of plant morphology (see list of terminology), including understanding sexual reproduction and dispersal of plants
5. Basic species identification of common everyday plants, including food plants (see list)

6. Variation in morphology, chemistry, toxicity, and genetics and how this can be used for bioprospecting of new crops and new medicines, etc.
7. Species identification methods and their limitations (DNA barcoding and morphology)
8. Basic rules for botanical nomenclature and importance of botanical accuracy in commercial products, media, and research reports

### **ASSESSMENT**

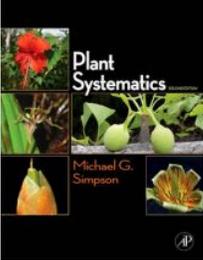
How you reach the learning goals in class will be assessed through the evaluation and grading of:

- Weekly Class Worksheets (independent or in groups)
- 4 quizzes in class
- Keeping of a personal species list of plant species encountered in everyday life (incl. spices, food plants, medicinal plant products, garden and agricultural plants, and wild plants)
- On-line, open-book, repeatable self assessments on course website (over 80% correct answers are needed for full points)
- The upload of wild plant observations to the iNaturalist website

### **COURSE WEBSITE** <https://ecollege.rutgers.edu>

The course website have syllabus, lectures, readings, self-assessment quizzes, links to on-line educational resources (movies, websites, podcasts) and projects, and dropboxes for uploading assignments. Please refer to the schedule to find each week's lecture, assignment, self-assessment, and other resources.

### **BOOKS and other COURSE MATERIALS**

	<p>Simpson, M. 2011. <b>Plant Systematics</b>, edition 2. Elsevier Press. (available at the Campus Bookstore). This is the text book for the lecture course and it will be necessary for the lab as well. <b>MANDATORY</b> Note, part of this book (family descriptions) will function as a dictionary to look up information in, the other chapters will be highly important to read carefully and understand.</p>
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To aid in your study, we are providing a **manual of how to identify the 50 most common families, a list of ethnobotanical and common wild species** you should learn, and a short list of **plant morphology** words you should know after the class is over.

### **ATTENDANCE and GROUP WORK RULES**

If you miss a class due to an emergency, let the instructor know as soon as possible. You may be able to arrange a make-up session as soon as possible. Even if you miss a class you will have to take the quizzes as scheduled. You can sometimes work in groups during the class (not at quiz time!) if you like, but NEVER copy anybody else's text for the assignments or projects. All work handed in by you should be your own work written in your own words. Any plagiarism or cheating will be reported to higher authorities (see Academic Integrity below).

### **PLANT AND FIELD SAFETY**

Many plants are poisonous and can cause severe reactions, even death. Be careful not to get anything in your eyes or your mouth, unless we specifically say it is edible. Wash your hands after working with all material. For the iNaturalist project: Dress in suitable clothes for any outdoor fieldwork– boots/sneakers, long pants and long-sleeved shirts are recommended. Be aware of ticks and mosquitos, poison ivy and plants with thorns. Do not go alone to remote places and bring a cell phone in case you get lost and need help.

### **GRADING and ASSIGNMENTS**

Undergraduates will be graded according to undergraduate standards, graduates according to graduate standards on worksheet and quiz assignments. All in-class quizzes are different for undergrads and graduates to reflect different learning requirements.

#### **Exams and grades**

There will be no theory exams and no final exam. All work for this class is done as graded projects in class, online and as independent projects outside of class. Four short quizzes on selected topics will be done in class (botanical nomenclature, phylogenetic understanding, botanical accuracy in medicinal plants, and botanical classification). Grades will be also given based on participation and attendance and effort and quality of produced work.

#### **Cheat sheet**

During lab quizzes you are allowed to bring with you 2 pages (one sheet) of *handwritten* notes on a cheat sheet (in any language). No computer text is allowed on these sheets, only your own handwriting. (It has been shown that the preparation by hand of such notes helps you learn the material, and is also an excellent way to provide yourself with a quick review in the future. You can write small, in different colors, and any text type you want, but you are only allowed one sheet for each quiz period, giving a total of 3 cheat sheets at the end of class (students usually keep these for future use). No other materials and help are allowed during lab quizzes. We will inspect all cheat sheets before the exam starts. **Note – cell phones and calculators are absolutely not allowed during quizzes.**

#### **Late hand-in**

Late submission of materials will get a lowered grade. If not handed in by 5 PM on the due date, any assignment will get an automatic immediate 20% point reduction, if still late after 3 days it will not be graded.

#### **Grading points**

	<u><b>points</b></u>
Course worksheets	120 (10 worksheets @ 10 points each)
Quizzes	60 (4 quizzes @ 15 points each)
On-line self-assessments	60 (12 self-assessments @ 4 points each)
Species observation list	20
iNaturalist observation upload	20
<u>Attendance and participation</u>	<u>20</u>
Total	300 points

For projects, points will be taken off for misspellings, wrongly formatted text, sloppiness, not adhering to given formatting guidelines and similar mistakes. There will be no curving of

grades. We will use the gradebook on the course website so you can check your current grade at all times. If you feel like you are falling behind, come and talk to us about ways to improve your performance. We are here to help you learn, and my goal is for all students to achieve an A if they put in the effort.

**Final grades:**

A 90-99 %

B+ 85-89 %

B 80-84 %

C+ 75-79 %

C 70-74 %

D 60-69 %

F less than 60% of total grade

There will be no curving of grades, however we reserve the right to up the grades of students that show outstanding participation in the class.

**ASSIGNMENTS and PROJECTS**

There are several assignments for this course. Most of the them are independent, i.e., not group projects. For all of these, see separate handouts with further instructions.

**Assignment 1:** Species observation list

**Assignment 2:** iNaturalist observation upload

**Assignment 3:** On-line self-assessments

**Assignment 4:** Course worksheets (in class)

*Online Self-assessments* are graded online so that you get 4 points for each assessment performed online, as long as you have at least 80% correct answers (but you have to answer all questions, not quit prematurely). {We are filling in the grade points manually for these}. The idea is that you should do the self-assessments as you go along in the textbook (repeatedly if you wish or need) to improve your learning. If you do the self-assessments you will improve your performance in class significantly and learn a lot more. This is a fact based on previous students' performance in this class. ☺

**Uploading of files:** Some assignments have to be handed in using the dropbox on the course website. Name the files YourName\_assignment1.pdf), and we only accept pdf or Word (.doc, .docx) files.

**ACADEMIC CONDUCT AND INTEGRITY**

*All instances of plagiarism or other unacceptable and unethical academic conduct will be reported to the Office of Student Conduct or the Graduate School and might result in warnings or suspension according to Rutgers official rules.* See special handout about Rutgers policy in Academic Integrity.

Especially, *write everything by yourself, and never copy text from the internet or publications* – we are using turnitin.com to check all text handed in by students. Please follow copyright laws and source citations when using images of any kind (see handout). Please remember to cite all sources for information (see handout). Reference lists have to include all authors and full title of each paper.

### **SOURCING, CITATION OF REFERENCES, USE OF IMAGES, etc.**

*Non-refereed, unscientific web sites are not acceptable as sources of information* unless for images or maps. You should get all information from books, book chapters, and scientific articles (these can of course be searched for, read on, and downloaded via the web). So, **DO NOT CITE WEBSITES**, unless they are **SCIENTIFIC** websites, that lists references and their facts have been checked. When you include a list of references follow the *correct citation format* (see instructions), and cite image sources properly. An url is not a source. See separate handouts regarding this with very important information.

### **NOTICE FOR STUDENTS WITH DISABILITIES**

Rutgers University welcomes students with disabilities into all of the University's educational programs. In order to receive consideration for reasonable accommodations, a student with a disability must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation: <https://ods.rutgers.edu/students/documentation-guidelines>. If the documentation supports your request for reasonable accommodations, your campus's disability services office will provide you with a Letter of Accommodations. To begin this process, please complete the Registration form on the ODS web site at: <https://ods.rutgers.edu/students/registration-form>.

## SCHEDULE

### Schedule 2015 (dates to be updated)

**Lectures:** Monday (9.15-10.35 AM, Foran 138B), Thursday (9.15-10.35 AM, Foran 138A)

<b>Date</b>	<b>Lect / Fieldtrip</b>	<b>Topics</b>	<b>Reading assignments and handouts</b> (always check course website for online links)
<b>Thu 5 Sep</b>	<b>lecture</b>	<b>What is Plant Evolution?</b> Introduction to the class, the website, the projects and labs.	Handouts: How to use eCompanion, Academic Integrity, Schedule, Syllabus, Family and species lists, Assignments; Reading: chapter 1
<b>Mon 9 Sep</b>	<b>lecture</b>	<b>Human health, food, agriculture and plant diversity, an evolutionary and historical perspective</b>	See readings on course website.
<b>Thu 12 Sep</b>	<b>lecture</b>	<b>Evolution and diversity of green and land plants: major groups and early green life</b>	Reading: chapter 3-4
<b>Mon 16 Sep</b>	<b>lecture</b>	<b>How do you identify plants? introduction to Personal Plant Observation project</b>	Reading: chapter 15 and course handouts
<b>Thu 19 Sep</b>	<b>lecture</b>	<b>Classification: Ferns, horsetails, conifers, etc:</b>	Reading: chapter 4-5
<b>Mon 23 Sep</b>	<b>fieldtrip</b>	<b>Floriculture greenhouse field trip.</b> Visit to living collections of tropical and subtropical plants. Family identification, plant morphology, ethnobotany.	Meet outside the entrance to Floriculture Greenhouse (on Nichol Avenue) when class starts. Bring '50 families' manual.
<b>Thu 26 Sep</b>	<b>lecture; QUIZ 1</b>	<b>Classification: Evolution of flowering plants &amp; basal angiosperms</b>	Reading: chapter 7
<b>Mon 30 Sep</b>	<b>lecture</b>	<b>Phylogenetic systematics; Tree-thinking</b>	Reading: chapter 2, 8
<b>Thu 3 Oct</b>	<b>lecture</b>	<b>Classification: Monocots</b>	Reading: chapter 7
<b>Mon 7 Oct</b>	<b>lecture</b>	<b>QUIZ 1</b> (first 30 min), then lecture on <b>Plant nomenclature and classification</b>	Reading: chapter 16. Handout: Understanding Latin names.
<b>Thu 10 Oct</b>	<b>lecture</b>	<b>Plant Molecular Systematics,</b> reconstructing evolution, DNA barcoding	Reading: chapter 2, 8
<b>Mon 14 Oct</b>	<b>lecture; QUIZ 2</b>	<b>QUIZ 2</b> (first 30 min), <b>Botanical Accuracy in commercial products and herbal medicine,</b> do scientific names matter?	Assigned reading from Botanical Accuracy.com and American Botanical Council (HerbalGram), see website
<b>Thu 17 Oct</b>	<b>lecture</b>	<b>Classification: Basal eudicots and Core Eudicots</b>	Reading: chapter 8
<b>Mon 21 Oct</b>	<b>lecture</b>	<b>Sexual Reproduction in Plants</b> (sexual reproduction), Guest lecture by Jennifer Blake-Mahmud	Reading: chapter 13
<b>Thu 24 Oct</b>	<b>lecture</b>	<b>Classification: Rosids</b>	Reading: chapter 8
<b>Mon 28 Oct</b>	<b>lecture</b>	<b>Non-Sexual Reproduction in Plants, Cloning, etc.</b>	Reading: chapter 13
<b>Thu 31 Oct</b>	<b>fieldtrip</b>	<b>Fieldtrip to Chrysler Herbarium: Why voucher your research plants?</b>	Reading: chapter 17-18 and see website. Handout: Chrysler herbarium.

<b>Mon 4 Nov</b>	<b>fieldtrip</b>	<b>fieldtrip to Geology museum to look at plant fossils, etc.</b>	See instructions on course website
<b>Thu 7 Nov</b>	<b>lecture</b>	<b>Classification: Asterids</b>	Reading: chapter 8
<b>Mon 11 Nov</b>	<b>lecture; QUIZ 3</b>	<b>QUIZ 3 (first 30 min), then debate on the safety of herbal medicine from a plant-species perspective</b>	See handouts on course website.
<b>Thu 14 Nov</b>	<b>lecture</b>	<b>Wild evolutionary origins of crop species (including spices and herbs) - domestication and ancient breeding</b>	See handouts on course website.
<b>Mon 18 Nov</b>	<b>lecture</b>	<b>Classification, Non-vascular plants: mosses, lichens, liverworts, algae, all the little things</b>	Reading: chapter 3
<b>Thu 21 Nov</b>	<b>lecture</b>	<b>"Invisible characters": Plant anatomy, physiology, embryology, chemistry, and palynology and their evolution</b>	Reading: chapter 10-12
<b>Mon 25 Nov</b>	<b>lecture</b>	<b>Carnivorous and parasitic plants</b>	See handouts on course website.
<b>Mon 2 Dec</b>	<b>lecture</b>	<b>Species concepts and conservation</b>	Reading: chapter 19.
<b>Thu 5 Dec</b>	<b>lecture</b>	Follow up and review of <b>Personal Plant Observation Project</b> ; course review	
<b>Mon 9 Dec</b>	<b>QUIZ 4; PARTY</b>	<b>Edible plants potluck party (after quiz)</b>	Bring your appetite.