

SYLLABUS FALL 2022

Plant Diversity and Evolution (11:216:411, undergraduate)

Plant Systematics (16:215:507, graduate)



*Welcome to the world of plants. Without plants you would be dead, but some plants can kill you. So, it is best to know which one is which and how to figure that out. **Make this course just the beginning. Learn who you share this beautiful, unique planet with. It is the first step in understanding how to live in a manner that will allow our species to continue for generations to come.***

“The more animals and plants I learned, the larger, more complicated and more familiar the world around me became.”
(Helen MacDonald, 2015).

Instructor

Dr. Lena Struwe (lena.struwe@rutgers.edu), 237 Foran Hall, Cook Campus, Rutgers University
Online office hours by appointment.

Credits: 3. An optional 1-credit companion lab (11:216:412/16:215:508) is available for students that want to dig deeper into the incredible world of botanical biodiversity and its evolution. If you are an EENR major and want Biodiversity credit for this course, then you must take both the lab and lecture. If you take the undergraduate lab, then you have to take the lecture course the same or a previous semester.

Class meeting time and place: 138A Foran Hall, Cook Campus. **Monday and Thursdays 8:30-9:50 am.** Additional asynchronous work is also part of the course.

Note: This syllabus is a plan and not written in stone. Plans can change. Any changes to the syllabus and/or schedule will be communicated to students on the course website (Canvas), and/or via e-mail announcements.

INTRODUCTION

The evolution and diversification of land plants have shaped life on Earth both in the geological past and today and are crucial for the survival of terrestrial ecosystems and the human species. Plants provide the vast majority of humanity's food, nutrients, and many medicines. About 50% of all modern pharmaceuticals are chemicals first discovered in nature, with most of those plant based. In addition, plants provide the O₂ we breathe, help regulate climate, the jeans we wear, the shelters we live in, and the fossil fuels we burn (ancient plants and algae). 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 has 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), understanding phylogenetics and nomenclature, and examples of morphological 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, and the accuracy in botanical names, and identification of unknown plants (edible, toxic, wild, cultivated, and weedy or invasive).



General information about class format

This class is not organized as a "lecture, study, exam" class. This class has been designed to increase students' learning, skills and knowledge building, and to build excitement and understanding of plant diversity in today's world and your lives. Therefore, the pattern of long lectures and cramming for a few tests is avoided. The class format is a hybrid of a flipped classroom with active learning activities, inside and outside, and some lectures and online quizzes.

The active learning components will include 1) posting of readings, short presentations and other resources that you should explore before each class or assignment, 2) weekly classes in person with lectures, short demos, many in-class assignments and worksheets, 3) graded short take-home worksheets, and 4) a graded longer-term class project focused on local plant biodiversity using iNaturalist. There are no large exams, but there are mandatory thematic short quizzes online. *(Graduate students also have a separate research project and presentation due since they have additional expectations on learning.)*

This learning format means that you will probably have to take more responsibility for your own learning and skills-building than you are used to from other classes. It is up to you to plan your time, read ahead, select readings or other learning methods (from provided choices), do the assignments on time, and generally keep on top of things. Use your curiosity, dig deeper, challenge yourself, have fun, and develop your skills and knowledge. I provide tools, resources, and advice to maximize your learning, but it is up to you to shape your knowledge and skills in a way that fits your future career choice and needs the best.

Before each class, make sure you check the website a few days before the lab class, download worksheets, explore the resources on the topic, and prepare yourself for the work you have to do. Grading of assignments will be based on content as well as effort. There are a lot of deadlines to spread out the work over three months, so keep track of them. Due dates are listed on the course website and in the schedule.

The class is not focused on memorization (except for morphology vocabulary and some major plant families – i.e., learning the language of botany), because most facts can now easily be looked up in books and online. Instead we will focus on developing foundation knowledge, how to find accurate botanical information, and identification and understanding of unknown plants, understanding plant morphologies, build your morphology and taxonomy vocabulary, develop critical thinking, and learn how to evaluate botanical facts. My hope is that you will develop a true understanding and love of botany that will be useful for the rest of your life.

LEARNING GOALS

In this class you will:

1. Build up vocabulary for plant morphological terminology to help in species identification, communication, and descriptions. (Theme: Morphology & Function)
2. Learn to recognize major plant families of New Jersey and be able to identify a living plant to its species (Theme: Identification of plants; Project: iNaturalist Species Project)
3. Be able to use and contribute to databases and scientific collections as part of plant research (Project: iNaturalist Species Project)
4. Understand the implications of biodiversity, migration, and dispersal of plants globally and locally (Theme: Biodiversity and Biogeography)
5. Understand how plant diversity has been discovered, described, and classified during the last 2000 years. (Theme: Herbaria, History, and Collections)
6. Explain and implement the rules for botanical nomenclature and classification based on phylogenetic information (Theme: Evolution, Classification, and Naming)
7. Recognize the major features, key innovations, and evolutionary diversifications of all major land plant groups through geologic time (Theme: Evolution, Classification, and Naming)
8. Describe types of vegetative and sexual reproduction in plants (Theme: Reproduction & Dispersal)
9. Understand the importance of botanical accuracy when it comes to sourcing, vouchering, marketing, and content in commercial botany-based products (Theme: Botany at Home)
10. Be able to investigate and account for the biodiversity, origins and uses of edible, toxic, cultivated, and medicinal plant species (Theme: Botany at Home)



COURSE WEBSITE <https://canvas.rutgers.edu/>

Sign in using your netID on the Canvas course website. **Make sure the e-mail listed for you in Canvas is the e-mail you check on a regular basis.** The course website has syllabus, calendar, presentations and videos, readings, quizzes, links to on-line educational materials, and places to upload certain assignments (check under Assignments tab to the left). The course website is divided up in themes (see schedule and learning goals) that are listed under Modules (listed on tab on left). Readings will be posted at least 3 days before due date and some assignments will be available in advance, so you can work ahead if you want. Please refer to the website frequently to find each class topic, assignments, deadlines, and other resources. **In-class worksheets will not be posted online, you will have to come to class to get these, even if due at a later date (only exception are excused absences for medical reasons, e-mail the instructors if you need to make up work due to an excused absence). Take-home assignments will sometimes be posted online, and sometimes require online upload. It is your own responsibility to make sure you follow all instructions provided in assignments, in the syllabus, and on the course website and do not miss any deadlines.**

HOW TO ASK A QUESTION

For questions to the instructor please ask before or after class, or post in the online question forum (unless personal, then please e-mail the instructor). If you e-mail the instructor, always include class name/number and your full name since we teach many classes and students. **A VERY IMPORTANT RULE:** You will not get an e-mail response if the answer to your emailed question is available on the course website and/or in the syllabus or schedule. Always check the website and syllabus first. Generally e-mails will only be answered 9-5 on weekdays.

RESOURCES, BOOKS, and OTHER MATERIALS

Reading

The required readings and any other pre-class preparation work are available on the course website. The textbook used in the lab class contains many useful chapters (it is optional for this class: Michael Simpson's *Plant Systematics*, ed. 2 or 3). See the end of the syllabus for recommended reference books for your professional library.



Mandatory Supplies you need to have access to

Hand lens. Preferably with added neckband so you don't drop it and lose it – good hand lenses can be bought online (for example, 10x magnification, 21 mm in diameter, either with or without a little built-in lamp – look for hand lens or loupe on Amazon, Carolina Biological, etc.). No need to buy anything expensive, and they usually cost \$6-\$10 for a basic type. You will also use the hand lens as a magnifier/zoom lens for the camera on your smartphone/tablet camera, so keep it with you at all times. Many botanists wear their hand lenses hung on a neck band around their neck at all times; you never know when you have to look at a stellate hair or into a strange flower. Any tool that magnifies the macroworld around you will be helpful to you and show you new things. Some students simply use their smartphone camera's zoom-in function as a handlens, but it depends on your phone if that will work well or not.

Digital camera. You need a smartphone or tablet with camera, or a digital camera. You will not be able to participate in class if you do not have access to a digital camera from which you can upload photos to the iNaturalist website. If you have a smartphone, we suggest you download the iNaturalist and SEEK apps.

Ruler (in cm/mm). You will learn in class how to use your hand and body as a ruler, but a real one is necessary for describing and keying out plants.

Computer or tablet with internet access. You will need internet and computer access to be able to take this class. No exceptions.

A small field notebook and a pencil. To take notes with when you are outside looking at plants.

Personal token: In the beginning of class you will select a personal token, a small object, that will always be in the photos you take for this class, like a signature that is your own. This will be explained at the beginning of class.

Books and other documents

Textbook: Simpson, M. 2011/2019. **Plant Systematics**, edition 2 or 3. Elsevier Press. This is the **optional** textbook for this lecture course; it is mandatory for the lab course.

Floras: There are many local floras (plant guide books) that will be very helpful for your work in class (recommendations at the end of this document). If you do not have one available, see if you can borrow one from a local library. See last page of syllabus for some recommendations.

Manuals and lists from the instructors: To aid in your study, we are providing the following manuals made by the instructors on the course website, and make sure you download these, print them out (or have them on your computer or tablet) and bring them to class when needed:

1. a manual of how to recognize the 50 most common plant families, plus a few pages about tropical families
2. a list of common plant families and major plant groups you should learn to identify (same as in lab)
3. a morphology vocabulary manual
4. a list of plant morphology words you should know
5. a manual on the naming of plants
6. two small field guides to common weeds in New Jersey

PLANT AND FIELD SAFETY

Many plants are poisonous and can cause severe reactions, even death (very rare!). Be careful not to get anything unidentified in your eyes or your mouth. Carefully wash your hands, tools, and the work area after working with all material. Dress in suitable clothes for the outdoor field trips and field collecting – 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/or need help. Bring drinking water. Use common sense and be responsible. To look professional and reduce risk when looking at plants in public places, you might consider carrying a clipboard and colorful safety vest on. Don't forget sunscreen and bug spray. **You are welcome to form informal groups in class and do field trips together.**

If you use kitchen equipment to cut up and dissect plants (knives, cutting boards, etc.) always wash everything you used thoroughly afterwards with soap and water. Some plants are toxic or can cause other problems. The best is to have a dedicated non-food cutting board and knife.



ASSESSMENT and GRADING

Grading and Points

Achievement of learning goals will be assessed through the evaluation of the following:

Activity	Points (undergraduate/graduate) [estimated]
Worksheets	100/100 (5 pts/each)
Online Quizzes	125/125
iNaturalist project	47/47
Graduate student research project	0/30
<u>Extra credit</u>	<u>27/27</u>
Total	272/302 points (excl. extra credit)

General grading policy

For projects and assignments, points will be taken off for insufficient or incorrect content, misspellings and grammar, wrongly formatted text, sloppiness, not adhering to given formatting guidelines, and similar mistakes. You can use the gradebook on the course website to check your currently earned grade at all times. If you feel like you are falling behind, come and talk to the instructor about ways to improve your future performance (you cannot redo work already submitted). The instructors are here to help you learn, and our goal is for all students to achieve at least a B+ when put in the effort needed to master the subject. There will be no curving of grades, however, the instructor reserves the right to upgrade final grade by one level (for example from B to B+) for individual students who show outstanding participation, improvement, and effort in the class.

Final grades

A	90-100 %	B	80-84.9 %	C	70-74.9 %
B+	85-89.9 %	C+	75-79.9 %	D	60-69.9 %
F	less than 60%				



Online quizzes

There is no midterm exams and no final exam. There are a couple of 1-hour quizzes on the themes that will be available to students for **48 hours** on select days (see Calendar on course website). You can start the quiz at any time during those 48 hours and you have **one hour to finish it in one sitting** (make sure you start it before 11 pm or your time will be cut short). You **cannot retake a quiz**, and do not wait to the last minute to take it, it will close at midnight. **The quiz is open book, questions will be randomly pulled from a test bank** (so no students will get the exact same combination of quiz questions), and you are allowed to use your notes, cheat

sheets, phone, books, computer and other resources to answer the questions (but **do not** contact your classmates or other potential helpers while taking the quiz). Questions will be multiple choice, fill in the blanks, pair up answers, and/or textboxes to be filled with your text. **If you google answers and copy in text from the internet into the answer box, then that is plagiarism. Write all answers to the longer questions in your own words.** A missed quiz can only be made up in case of excused absences due to emergencies. Quizzes are partially autograded, partially manually graded so the final grade of each quiz is not immediately available to you after you have taken the quiz.

Assignments

These will be handed out in class, and not be available for download, unless the assignment requires online upload or addition of digital data. Deadlines for assignments are FIRM, including deadline times. **There will be no extra time given to complete in-class assignments outside of class if they are due in that class period.** Therefore, come to class prepared by having reviewed readings and other learning resources ahead of class.

When observing and evaluating plants and their characters, photos and drawings are an invaluable tool. Draw many pictures of plant parts, but **DO NOT COPY AND POST** images from the internet into your online worksheet unless you specifically have been asked to be doing so (and if so, give the source). Mark down the names of their parts and the plants (scientific genus and family names required). Write legible and neatly (you may use a computer and image edit program for online worksheets). **Worksheets that cannot be read by us will not be graded.** Grades will be assessed on both drawings and text (content and understanding only, not artistic ability - no Leonardo da Vinci is expected here). **For photos include your personal token in at least one photo per plant you report on, and also include something to show the scale (your finger is fine) if possible.**

iNaturalist assignment

A major part of the class grade is an assignment to upload at least 25 wild or naturalized plant species that you have found and photographed (see instructions), and then identified to species (it is OK to get help from others with identification, that is part of the community science aspect of iNaturalist). For extra credit, make sure your 25 species are in the categories listed on the iNaturalist Bingo Sheet, and submit that for extra points.

When you hand in and report research data to iNaturalist, you will guarantee that your data and observations are truthful and accurate when it comes to locality and date, and that they are your own personal photos and observations. If you report observations, photos, or other data to iNaturalist that aren't your own then it will be considered cheating and be reported. If this happens even for a single one of your observations, you will get 0 on the whole project – iNaturalist is a real scientific project and all image and locality data has to be 100% correct and original (of course, species IDs can change). If you get banned from iNaturalist due to posting inappropriate or offensive observations, spam, copyrighted images from other sources, or other behavior, then you will also get a 0 on the project.

Extra credit

Extra credit work will be listed in the schedule on the course website and has firm deadlines. It is up to you if you do them or not.

ATTENDANCE, ABSENCES, and MAKEUP WORK

Attendance

There is no attendance grade and attendance requirement during the in-person classes, however, you will miss out on graded in-class assignments, lectures, important information, and the ability to ask questions if you do not attend.



Late submission of work

Delayed hand-in of assignments will get a lowered or zero grade. In-class, same-day worksheets have to be handed in at the end of the same class in person (by 9:50 AM). Take-home and online assignments have specific due dates; and should be handed in on the due date on the course website or in the classroom by the end of class, 9.50 AM. **If less than 24 hours late, you will get a 50% deduction from your actual grade on the assignment** (for example, if your work is worth 9 points out of max 10 max, then your late grade will be 4.5 points). **If late more than 24 hours, the grade will automatically be 0 on the assignment.** You may deposit late on-paper assignments in the mailbox for Dr Struwe in the mailroom in 290 Foran Hall (only open until 5 PM). **Online self-assessments have completely firm deadlines and are inaccessible after the due date and time.**

Absences due to medical and personal emergencies, make up work possibilities

If you are absent due to illness or other emergency reasons, you have to **report it using the online student absence system** (<https://sims.rutgers.edu/ssra/>); this will keep track of your number of absences in class and send an automatic e-mail to the instructor. Such absences must be reported as soon as possible (preferably within 2 days, at least within one week). If you do not report a medical absence through the Rutgers system you will not get permission to make up the work. Medical absences are automatically excused absences.

Make-up work is only available for excused absences. Requests for makeup work has to be made as soon as possible (no later than 5 business days after your return to class) and make-up work has to be finished within 5 business days after being handed out to the student. **IMPORTANT:** Make-up quizzes will only be provided for documented medical absences (A letter from the Dean of Students is acceptable).

Requests for having non-medical and personal emergency absences to be treated as excused absences will be handled on a case-by-case basis. If you know you are going to be absent in advance, you need to find out if your absence will be excused by contacting the instructor via e-mail, provide documentation and justification, and do this at least 5 business days before your planned absence. For personal emergencies, please contact the instructor as soon as possible to explain and ask for advice. If you have extensive medical or other long-term absences, contact the Dean of Students to provide the instructor with a letter confirming your need for make-up work.

In case of cancelled class

Weather, instructor illness, and other emergencies might lead to cancelled class– if so, instructions will be e-mailed to all students and also posted on the course website. Keep an eye on weather reports and your e-mail, since storms, etc., might lead to cancellation of in-person classes, and work will then be posted online instead. If for some reason you cannot get to

campus for class due to such emergencies, please e-mail the instructor with an explanation. Extreme weather is a fact these days, and we want all students to be safe.

COVID SAFETY

Even though we are back in person, we recognize things are not entirely back to normal. To reduce the risk of spreading COVID, **masks must be worn in classrooms at all times.**

If you are unable to come to class because of COVID, we will work our best to accommodate. In cases of illness, see the above policies regarding absences. In cases of isolation (e.g., due to a sick roommate, or isolation after a positive test but without symptoms), we will provide alternate assignments that can be completed at home, where you can avoid close contact with others.

If we *instructors* are unable to come to class because of COVID, we will send information through email and Canvas announcements. In such cases, we will likely provide alternate, remote assignments. **So, please be attentive to email and Canvas alerts!**

USE OF ELECTRONIC DEVICES IN THE CLASSROOM

Any texting/cellphone/tablet/laptop internet use is not permitted in the classroom during class, **unless specifically allowed by the teacher for specific assignments that day.** If you have issues with taking notes by hand, please talk to the instructor. Remember, taking notes by hand will make you learn more than taking notes on the computer as per recent research. **Any use of your phone, tablet, or computer for activities not required for class while class is in session may result in you being asked to leave the classroom and also affect your assignment grade for that class.**

PRIVACY

You are **not allowed** to record, photograph, or otherwise capture students' and the instructor's faces, sounds, images and words in the classroom and on the course website without permission. This is for privacy reasons and to make everyone feel comfortable in class. You are of course allowed to share the public botanical resources shared on the course website. If in doubt or have special needs, ask for permission. We expect everyone to practice mutual respect and care for each other.

ACADEMIC CONDUCT AND INTEGRITY

All instances of plagiarism or other unacceptable academic conduct **will be reported to the Office of Student Conduct or the Graduate School and might result in a warning, a mark on your permanent record, dismissal or suspension** according to Rutgers official rules. The rules are available here: <http://academicintegrity.rutgers.edu/>)

In short, to avoid plagiarism or paraphrasing in submitted work, **write everything by yourself, and never copy text or images from the internet or publications or other students** – we are using turnitin.com to check all text handed in by students.

Make your own observations, drawings, and written text. Copying equals plagiarism, so do not do it. You can of course communicate with others in the class about your work, but the work you present must be your own discovery. If two students submit the same or extremely similar work, both students will be investigated for plagiarism and possibly reported. **NEVER** copy anybody else's text or images for the worksheets.

In written text, please remember to cite all sources of information. When you include a list of references follow a complete citation format (author, year, title, journal, book, page numbers, etc.; see instructions). Non-refereed, unscientific web sites are not acceptable as sources of information. So, do not cite websites, unless they are scientific websites, that lists references and their facts have been checked. Cite all image sources properly, and also include

information that you is the source if you took the photo. Please follow copyright laws and give credit to the source when using images of any kind (see course website for information). An url is **not** a source or copyright information. See instructions on the course website on how to cite sources and images.

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> . If you already have disability accommodations for quizzes and assignments, etc., let us know by forwarding your accommodation letter to the instructors of the class.



STATEMENT OF DIVERSITY AND INCLUSION

It is our intention that students of all backgrounds will be well served by this course. We will work to create an environment of **inclusion** which respects and affirms the inherent dignity, value, and uniqueness of all individuals, communities, and perspectives. We are lucky to have a diverse university. Diverse voices and life experiences enhance the learning process, and we welcome students to share their personal experiences. We will not tolerate disrespectful language or behavior against any individual or group. If you feel as though you have been disrespected or treated unfairly by the instructors or any other individual, please let us know. You may speak with the instructors in person, over email or report anonymously using the feedback note box. You may also report bias to the Rutgers Diversity and Inclusion initiative using this link: <http://inclusion.rutgers.edu/report-bias-incident/>.

LAND ACKNOWLEDGEMENT

We acknowledge that we will be conducting class and observing plants on the traditional homelands of the Lenape people or other indigenous groups. **Why do we recognize the land?** “To recognize the land is an expression of gratitude and appreciation to those whose territory you reside on, and a way of honoring the Indigenous people who have been living and working on the land from time immemorial. It is important to understand the long-standing history that has brought you to reside on the

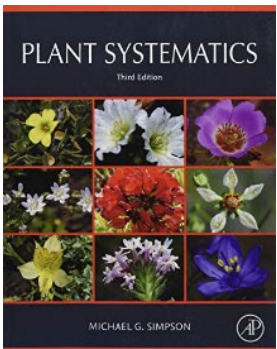
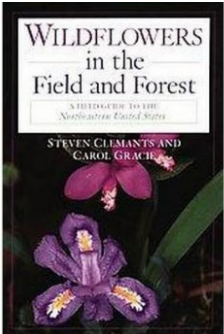
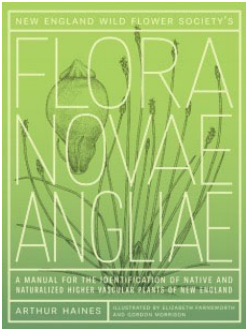


land, and to seek to understand your place within that history. Land acknowledgements do not exist in a past tense, or historical context: colonialism is a current ongoing process, and we need to build our mindfulness of our present participation. It is also worth noting that acknowledging the land is Indigenous protocol.” (Sourced from <http://www.lspirg.org/knowtheland/>.)

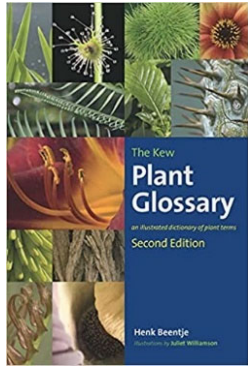
SECURITY OF BASIC NEEDS

Any student who has difficulty affording groceries or accessing sufficient food to eat every day, or who lacks a safe and stable place to live, and believes this may affect their performance in the course, is urged to contact the Dean of Students for support. Furthermore, please notify the professor if you are comfortable in doing so. To reach the Rutgers Student Food Pantry please call 848-932-5500. A 2018 survey found that 1/3 of all students at Rutgers have experienced food insecurity at some point during the semester. There is help to get if you do not have enough to eat, don't have a safe place, etc.

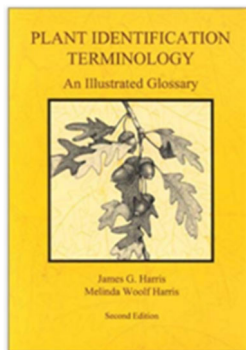
OPTIONAL, RECOMMENDED BOOKS

	<p>Simpson, M. 2019. <i>Plant Systematics</i>, edition 3 (or ed. 2, see below). Elsevier Press. We will use this book in lab every week, but it is optional for the lecture class. If you get edition 1 or 2 there will be differences from edition 3 and some chapters will be missing or rewritten; you may use edition 1 and 2 if you want at your own risk. This is a great book for starting your career in plants and you will use it often.</p>
	<p>Clemants, S. & C. Gracie. 2006. <i>Wildflowers in the Field and Forest: A Field Guide to the Northeastern United States</i> (Jeffrey Glassberg Field Guide Series). Oxford University Press. OPTIONAL BOOK, but it is highly recommended to have at least one local flora. However, only includes wildflowers, so no trees, shrubs, or grass-like plants are included. Great photos.</p>
	<p>Haines, A. 2011. <i>Flora Novae Angliae: A manual for the identification of Native and Naturalized Higher Vascular Plants of New England</i>. New England Wildflower Society & Yale University Press, New Haven. OPTIONAL BOOK but highly recommended for those of you that will continue to identify wild plants after the class is over. Includes all vascular plants, many line drawings, no photos. Comprehensive with good keys, no photos, small drawings, and covers nearly all New Jersey plants even if we are not in New England. The companion website is GoBotany.</p>

	<p>To aid in your study, Dr. Struwe created a manual of how to identify the 50 most common families (download the pdf here: https://botanydepot.com/2018/01/28/50tempmanual/) a list of families that you should be able to recognize and a worksheet for these (printed handout and on course website), a list of ethnobotanical and common wild species (printed handout and on course website) you should learn, and a list of plant morphology (printed handout and on course website) words you should learn.</p>
	<p>Weakley, A. 2020. <i>Flora of Southeastern North America: New Jersey</i>. This work contains all wild and naturalized vascular plants of New Jersey, and you can use it to key out and check identifications. It is available as a free pdf file on the course website. It does not have any images, but includes good keys and descriptions to all species.</p>
	<p>Rhoads, A.F. & T.A. Block. 2007. <i>The Plants of Pennsylvania: An Illustrated Manual</i>. Ed. 2. University of Pennsylvania Press. OPTIONAL BOOK but highly recommended for those of you that will continue to identify wild plants after the class is over. Includes all vascular plants, some line drawings, no photos. Totally comprehensive with good keys, and covers most of New Jersey plants around the Rutgers Campus. Heavier and thicker than <i>Flora Novae Angliae</i>, but somewhat easier to use.)</p>
	<p>Pell, S. & B. Angell, <i>A Botanist's Vocabulary: 1300 Terms Explained and Illustrated</i>. Timber Press. Recommended and optional, but there are many other useful books out there about plant morphology and the meaning of scientific words. Floras also usually contain glossaries.</p>



Beentje, H. 2016. *The Kew Plant Glossary: An Illustrated Dictionary of Plant Terms*. 2nd ed. Royal Botanic Gardens, Kew. Comprehensive dictionary of botanical terms, worldwide scope.



Harris, J.G. & M. W. Harris, *Plant Identification Terminology: An Illustrated Glossary*. 2001. Spring Lake, Publ. Useful for morphology and botanical terms.