# Plant Diversity (Biology 348)
## Spring 2023
(Lecture: MWF 8:30 – 9:20 am, ISC 137; Lab: T, 1:30 – 4:20, ISC 206)

**Course overview**

Plants are ubiquitous in our environment and vital to our survival, yet their diversity and elegant design often go unappreciated, even by many biologists. This course provides an overview of the remarkable biology and variety of inanimate forms of life including archaea, bacteria, protists, fungi, and algae, with an emphasis on the nonvascular and vascular plants. We will explore the characteristics that unite and distinguish these organisms. The course will span levels of organization from the cell to tissues and organs and the whole organism, and explore aspects of metabolism, physiology, ecology, and evolution. We will consider how plants grow, reproduce, and respond and adjust to their environments. Plants play key roles in ecosystems, not only because they are foundations of food webs and providers of habitat, but also because they interact with so many other organisms. And of course, humans benefit greatly from the products of these primary producers like fiber, wood, medicine, and food, and the ecosystem services they provide through nutrient cycling, the water cycle, sequestering carbon, and contributing oxygen to our atmosphere.

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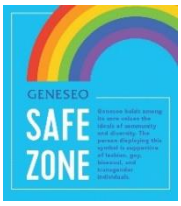
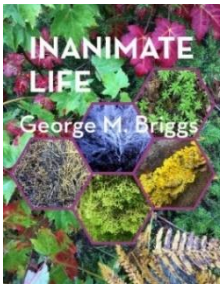
Instructor: Dr. Jennifer L. Apple (*she/her/hers*) Office: ISC 258 Lab: ISC 340
Contact: e-mail: applej@geneseo.edu (preferred) Phone: (585) 245-5442
Office hours: In person (ISC 206) or virtual (Teams): M 11:30 am-12:30 pm, W 4-5 pm
Virtual only: R 10:30 – 11:30 am (see Canvas for how to connect)




Course description from Bulletin: This course covers bacteria, algae, fungi, and both vascular and nonvascular plants. The structure, function, ecology, and economic importance of these groups will be introduced both in lecture and in lab. (4 credits; 3 hrs lecture/3 hrs lab) Prerequisites: Biol 117 and Biol 119

Course website: canvas.geneseo.edu

What you will need: Internet access and laptop computer.

Required textbook: *Inanimate Life* by George M. Briggs. Milne Open Textbooks. Available as an ebook or download the pdf here: https://milnepublishing.geneseo.edu/botany/

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**Learning outcomes**

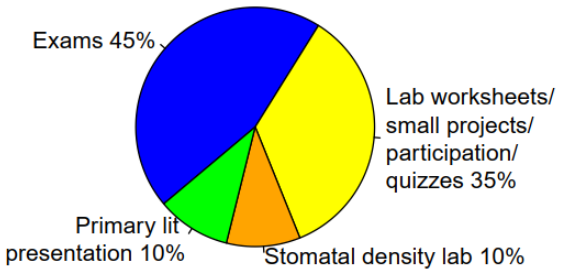
Successful students in this course will be able to

- recognize the major forms of inanimate life and the characteristics that distinguish them, be able to identify a set of key organisms, and to document plant diversity through field observations
- identify examples of how form and structure contribute to function
- describe patterns in asexual and sexual reproduction in fungi, algae, non-vascular, and vascular plants
- explain how plants obtain and use matter and energy to grow
- identify plant adaptations related to interactions with other organisms and ecological significance of such interactions
- explain how plants provide key resources and ecosystem services valuable for humans
- effectively communicate through written and oral forms the context, interpretation, and significance of research findings, and apply information from primary literature

**Overview of course activities**

The lecture portion of the course will introduce you to many aspects of the biology of plants and other forms of inanimate life: classification and evolutionary history, anatomy, structure and function, physiology, development and growth, reproduction, and ecology. We will also address the importance of plants to human well-being. In the course laboratory, through both lab activities and field trips, you will gain experience in identifying different forms of inanimate life and the characteristics that distinguish them. You will learn to identify aspects of their anatomy and how they relate to their function. We will also conduct several multi-week studies to address particular questions in plant biology. Some lab activities will involve data interpretation and analysis.

**How is your grade determined?**




Exams (45% of grade)

You will be assessed on your knowledge of material presented in lab and lecture through several exams delivered during our lecture period. There will be four exams: the first three will each be worth 10% of your grade, and the final exam will be worth 15% as it will also include a lab practical component. Except for the lab practical component, the final exam will not be cumulative. Throughout the semester, study questions will be posted in a Google Doc to help guide your review.

Lab worksheets, small projects, participation, and quizzes (35% of grade)

Some labs will involve completing worksheets or some other small final product. You will be expected to answer questions and make drawings based on your observations during field trips, and you will turn in your field notebook the day after each trip for me to review. Several large assignments, your field guide entries and your phenology observations, will also be included in this part of your grade. This category will also include participation in in-class activities. You will have weekly online quizzes to help you keep up with the course reading and lecture material.

Stomatal density lab report (10% of grade)

In the stomatal density lab project, you will be responsible for coming up with a question and hypothesis to test, designing your sampling strategy, and collecting and analyzing your data. You will give a short presentation in lab on your results from your stomatal density lab, and then prepare a full written report in the style of a typical scientific paper.

Primary literature paper presentation (10% of grade)

You will be sharing a primary literature paper on a topic in plant biology of your choice through a short oral presentation during one of our class periods. The paper must come from a list of pre-selected journals and be approved by the instructor.

Grading scale

| | | | | | |
|---|---|---|---|---|---|
| A | 93-100% | B | 83-86.9% | C | 73-76.9% |
| A- | 90-92.9% | B- | 80-82.9% | C- | 70-72.9%/ |
| B+ | 87-89.9% | C+ | 77-79.9% | D | 60-69.9% |

I follow conventional rounding procedures, so a 92.94% would represent an A- (rounded down to 92.9%), while a 92.95% would be rounded up to 93.0% and an A.

## How to be successful in this course

Come prepared to class and lab sessions

You will get more out of the course and each class and lab session if you follow instructions on Canvas for any necessary preparations like readings in our textbook, supplementary readings, watching videos, or viewing websites. It is your responsibility to check Canvas and your e-mail frequently for course-related announcements. Make sure you set your notifications in Canvas to keep up to date with course activities. Take advantage of course resources and study aids

I continually update a Google doc with study questions that you can use to help guide your review of course material (available in a Google drive folder; make your own copy to create a version you can edit). PDFs of the lecture slides are also posted in a Google drive folder.

Ask me for help

*Office hours*. I will be available in our lab room ISC 206 at designated times for in-person office hours and will also offer some virtual office hours via Microsoft Teams. See Canvas for details. If any of the posted times do not suit you, you can email me to set up another appointment for a video conference. When doing so, please suggest some possible times that you are available to meet in your email to make our correspondence more efficient.

*Email communication.* I can often answer your questions by email as well. I will try to get back to you within 24 hours.

Back up your work

Do yourself a favor to avoid last-minute computer calamities and stress by saving your work frequently and backing up your files using a cloud storage system like Google Drive, OneDrive, Dropbox, or some other service. CIT provides some tips on data backup. Also, don't wait until the day before a deadline to get started!

Respect our learning environment

Please help promote an effective learning environment by avoiding distractions and disruptions to others. Silence your cell phone and refrain from texting/browsing while in class. I will permit the use of laptops for taking notes (and of course in-class activities that require them) but will ask you to turn them off if I see they are not being used for classroom activities and/or are distracting to others. Please be courteous to me and your classmates by arriving on time.

## Attendance guidelines, COVID-19, and your physical and mental health

Guidelines for attendance and public health considerations

SUNY Geneseo is a residential liberal arts college where we all learn together in a shared space. Our classroom community is vital for engaging in discussions, solving problems, and answering questions together. I strive to create an interactive and collaborative classroom space, and in return I expect you to attend and engage in the activities.

We know that COVID is shifting from a pandemic to endemic stage, and it's possible that some of you may get infected over the course of the semester. Because we want you to be successful and because we value your contribution to the course, we expect you to prioritize consistent attendance. If you are experiencing symptoms associated with COVID on a day we have class, please take a self-test. If you test

negative and feel well enough to attend, put on a well-fitting mask, come to class, and maintain physical distance as much as possible. If your symptoms do not allow you to attend class, stay home (except to go to the health center), rest, and take care of yourself. See this page if you have questions about COVID, like what to do if you test positive or are exposed to someone with COVID: https://www.geneseo.edu/covid. I can support you to keep up with class if you are out for COVID or other health-related reasons, but I need you to be proactive in letting me know when you are out and why. Although I can work with you on keeping up, you may miss some course content and extended absences may impact your ability to realize your full potential in this class. For extended absences (i.e., more than a couple of days of classes), you should contact the Dean of Students (585-245-5706, http://www.geneseo.edu/dean_students) who can assist with reaching out to all of your professors about challenges you face and accommodations you may require. I want you to succeed and learn in this class, and I want to protect our community from COVID as best as I can.

Student well-being and mental health

Prioritizing well-being can support the achievement of academic goals and alleviate stress. Eating nutritious foods, getting enough sleep, exercising, avoiding drugs and alcohol, maintaining healthy relationships, and building in time to relax all help promote a healthy lifestyle and general well-being.

As a student, you may experience a range of challenges that can impact your mental health and thus impact your learning; common examples include increased anxiety, shifts in mood, strained relationships, difficulties related to substance use, trouble concentrating, and lack of motivation, among many others. These experiences may reduce your ability to participate fully in daily activities and affect your academic performance. Students are strongly encouraged to communicate their needs to faculty and staff and seek support if they are experiencing unmanageable stress or are having difficulties with daily functioning. The Dean of Students can assist and provide direction to appropriate campus resources.

SUNY Geneseo offers free, confidential counseling for students at the Lauderdale Center for Student Health and Counseling; seeking support for your mental health can be key to your success at college. You can learn more about the various mental health services available on campus at health.geneseo.edu. To request a counseling appointment, please complete the online form through myhealth.geneseo.edu. Getting help is a smart and courageous thing to do -- for yourself and for those who care about you.

**Diversity and inclusion**

The Department of Biology has pledged to develop more inclusive pedagogical practices and work to promote diversity in our curriculum while confronting racism, particularly ways in which science has been used to sustain it (Biology Department's Statement in Support of Racial Justice, also available on Department of Biology website). This course is no exception, and to help achieve these goals I will be highlighting the work of scientists of diverse identities and backgrounds in the field of plant biology. I hope to create an inclusive and supporting learning environment in which anyone can succeed, regardless of your identity (race, gender, ethnicity, sexual orientation, age, socioeconomic status, religion, and ability). I want to provide for students' growth as scientists and learners and promote a sense of belonging.

**Land acknowledgment**

Land acknowledgements are expressions of sorrow and remembrance to those whose historic territory one resides on. Geneseo resides on the historic homelands of the Seneca Nation of Indians and Tonawanda Seneca Nation. As stated in the Community Commitment to Diversity, Equity, and Inclusion, "we at SUNY Geneseo have an obligation to recognize all who, through history or identity, have been marginalized or oppressed, made invisible or silenced." I encourage you to keep in mind the original

occupants of the field sites we explore in this course. We will consider traditional ecological knowledge in relation to some topics in plant biology and learn about the roles of local native plant species in Native American culture. You may consider using the Native Land app and/or websites such as sni.org to learn more about the community of more than 7,000 enrolled Indigenous Peoples**.**

## Lab and field work and safety

### Lab preparation

If we are doing a field-based activity, you should be dressed for the weather with appropriate outerwear and shoes that can get muddy or wet – it is your responsibility to check the weather conditions and use your judgment about what to wear. Sometimes plans for a lab session may change at the last minute because of the weather; you should make sure to check your email on the day of a lab to find out any changes. Please be courteous to the instructor and your classmates by arriving on time, particularly on field trip days. Pay attention to announcements on Canvas that may ask you to bring your laptop for the day's activities.

### Lab and field safety

Your safety and comfort are important to me. Please be prepared for our field trips by dressing appropriately for the weather and terrain, bringing water, and carrying any medication you might need (allergy medication, inhaler for asthma, epipen, etc.). Inform me of any allergies (particularly to bee stings!) or other medical conditions that could require emergency treatment. Also be prepared by applying sunscreen when appropriate or wearing clothing to protect yourself from the sun. We could encounter mosquitoes, ticks, other biting/stinging insects, and poison ivy on our outings, so be aware of these risks, and feel free to ask me any questions about them. Also, be mindful of your safety if you go to a field site on your own outside of our regular lab sessions. It is a good idea to bring a friend with you, or at least to tell someone where you are going and when you expect to be back.

No food or drink containers are permitted in the lab, either during or outside regular lab times.

## Other course policies

### Late work

Online quizzes should be completed by the indicated due date to help you keep up with course content. Once closed on Canvas the quizzes will not be opened again unless there are extenuating circumstances. Your lowest quiz grade will be dropped. Graded assignments will be penalized by a loss of 5% of the total assignment's points possible per day. But if you think you must turn in something late because of extenuating circumstances, feel free to discuss the situation with me and we can negotiate terms.

### Plagiarism and academic dishonesty

Plagiarism and other forms of academic dishonesty (cheating, turning in another student's work as your own) will not be tolerated. Evidence of academic dishonesty is grounds for a score of zero on any assignment and further action including notifying the department chair, Dean of Academic Planning and Advising, Dean of Students, and Student Conduct Board, which can result a report filed with the Dean of Students.

Plagiarism. According to the Academic Dishonesty Policy in the Student Handbook (https://www.geneseo.edu/handbook/academic-dishonesty-policy), plagiarism includes the following:

1. direct quotation without identifying punctuation and citation of source;
2. paraphrase of expression or thought without proper attribution;
3. unacknowledged dependence upon a source in plan, organization, or argument.

In SUNY Geneseo's policy, "Plagiarism is the representation of someone else's words or ideas as one's own or the arrangement of someone else's material(s) as one's own." Take care to properly cite sources of ideas, figures, data, etc. (including internet sources) in your writing and presentations. Even if you properly cite your source, when you borrow wording and sentence structure from the original source and pass it off as your own (i.e., by not using quotation marks), you are guilty of plagiarism. Learn how to paraphrase in your own words information from the original source.

*Use of AI tools.* All work on written assignments should be in your own words and represent your own thoughts and opinions. You may not use a large language model, such as OpenAI's chatGPT, to edit or generate text because it is not guaranteed to be free from using the intellectual products of others.

Copyright statement

Many of the materials that are provided to students in this course have been created by me. Students would be best to assume that all course materials are protected by legal copyright. Copyright will be indicated by a "© DATE AUTHOR" on the document. Copyright protection means that reproduction of this material is prohibited without the author's consent. Thus, students are prohibited sharing or posting copyrighted material to any websites outside our course Canvas site. Students are also prohibited from reproducing material to be shared with other more limited groups (*e,g.*, sorority/fraternity test bank).

Religious observation and class attendance

New York State Education Law 224-a stipulates that "any student in an institution of higher education who is unable, because of [their] religious beliefs, to attend classes on a particular day or days shall, because of such absence on the particular day or days, be excused from any examination or any study or work requirements" (see https://www.geneseo.edu/apca/classroom-policies). SUNY Geneseo has a commitment to inclusion and belonging, and I want to stress my respect for the diverse identities and faith traditions of students in my class. If you anticipate an absence due to religious observations, please contact me as soon as possible in advance to discuss your needs and arrange make up plans.

Military obligations and class attendance

Federal and New York State law requires institutions of higher education to provide an excused leave of absence from classes without penalty to students enrolled in the National Guard or armed forces reserves who are called to active duty. If you are called to active military duty and need to miss classes, please let me know and consult as soon as possible with the Dean of Students.

**Student success resources**

Accessibility and accommodations

SUNY Geneseo is dedicated to providing an equitable and inclusive educational experience for all students. The Office of Accessibility will coordinate reasonable accommodations for persons with documented physical, emotional, or cognitive disabilities to ensure equal access to academic programs, activities, and services at Geneseo. Students with letters of accommodation should submit a letter to each faculty member and discuss their needs at the beginning of each semester. Please contact the Office of Accessibility Services for questions related to access and accommodations: access@geneseo.edu, 585-245-5112, www.geneseo.edu/accessibility-office.

Reporting bias-related incidents

Here at SUNY Geneseo, we want to provide a space where everyone feels welcome to learn and grow in their identities as well as in their role as students, faculty, and staff. If in the unfortunate instance you experience an incident of bias, we encourage you to reach out to the we encourage you to reach out to the Chief Diversity Officer (routenberg@geneseo.edu), Director of Multicultural Programs and Services (seloievans@geneseo.edu), and/or our University Police Department. In trying to create an environment that facilitates growth through diverse thoughts and ideas, reporting incidents of bias - including threats, vandalism, and microaggressive behaviors - can help bring a better understanding of our campus climate as well as provide opportunities for learning and restoring harm.

Other resources

Additional resources are available to support your academic success and well-being, including academic support services, library research help, computer and technology support, food security support, and emergency funding. See the "Student Success Resources" link on the Canvas course page for more information about these services.

**Other learning outcomes met by this course**

In addition to the specific learning outcomes outlined on p. 1, this course also fulfills learning outcomes for the SUNY Natural Science General Ed requirement and for the Sustainability component of the "Participation in a Global Society" area of Geneseo's Learning Outcomes for Baccalaureate Education (GLOBE).

SUNY Natural Science General Ed requirement

Through the lecture and/or lab components of the course, students will demonstrate

- the ability to analyze data
- understanding of the methods scientists use to explore natural phenomena, including observation, hypothesis development, measurement and data collection, experimentation, evaluation of evidence, and employment of mathematical analysis
- the ability to apply scientific data, concepts, and models

GLOBE Sustainability requirement

Students will be able to

- identify and analyze major sustainability challenges and solutions at local to global scales;
- understand the interactions between political, economic, socio-cultural, and environmental systems;
- understand the roles of power, influence, and inequity in sustainability.

**Plant Diversity Course Schedule**

This is a tentative course schedule that is subject to change. Readings refer to chapters in the textbook *Inanimate Life*. Additional short readings or other media to view before class or lab (or other instructions to prepare for class or lab) will be posted on Canvas. Canvas will have the most updated schedule of topics and assignment deadlines – pay attention to emails and course announcements. Exam dates will remain fixed unless changes are necessitated by changes in the public health situation.

| Week | Day | Date | Topic/activity | Reading/Assignments due* |
|---|---|---|---|---|
| **Unit** | **1** | | **Structure & reproduction** | |
| 1 | T | 1-24 | **LAB: greenhouse/campus exploration** | |
| 1 | W | 1-25 | Overview of course: what is an organism? | 1-Organisms; 2-Taxonomy & Phylogeny |
| 1 | F | 1-27 | Boundaries: cell walls & other structures | 3-Boundaries |
| 2 | M | 1-30 | Cellular structure of inanimate life forms | 4-Organism form: composition, size, shape; 5-Cellular structure in inanimate life |
| 2 | T | 1-31 | **LAB: selection experiment** | |
| 2 | W | 2-1 | What are algae? activity | |
| 2 | F | 2-3 | Patterns of asexual & sexual reproduction in algae | 11-Reproduction and sex |
| 3 | M | 2-6 | Fungal sex and fungal groups | 12-Fungal sex and fungal groups |
| **3** | **T** | 2-7 | **LAB: Cells & tissues** | |
| 3 | W | 2-8 | Nonvascular plants, vascular seedless plants | 6-Organ, tissue, and cellular structure; 13-Sex and reproduction in non-seed plants |
| 3 | F | 2-10 | Seed plant reproduction | 14-The development of seeds; 15-Sex and reproduction in seed plants, pp. 263-269; **Primary literature paper choice due** |
| 4 | M | 2-13 | Reproduction in flowering plants | 15-Sex and reproduction in seed plants, pp. 269-276 |
| 4 | T | 2-14 | **LAB: C-fern observations** | |
| 4 | W | 2-15 | Evolutionary transitions | |
| 4 | F | 2-17 | **EXAM I** | |
| 5 | M | 2-20 | Flower & fruit structure | |
| 5 | T | 2-21 | **LAB: grocery store botany; fruit & flower structure** | |

| Week | Day | Date | Topic/activity | Reading/Assignments due* |
|---|---|---|---|---|
| **Unit** | **2** | | **Development & metabolism** | |
| 5 | W | 2-22 | Plant development: roots | 7-Producing form: development |
| 5 | F | 2-24 | Primary shoot growth; vascular tissue development | 8-Vascular plant anatomy: primary growth; **Primary literature paper analysis due** |
| 6 | M | 2-27 | Cellular respiration | 18-Matter, energy, and organisms; 19-Cellular respiration |
| 6 | T | 2-28 | **DIVERSITY SUMMIT – no lab** | |
| 6 | W | 3-1 | Photosynthesis | 20-Photosynthesis |
| 6 | F | 3-3 | Leaf design activity | |
| 7 | M | 3-6 | Cues to development | 16-Reproduction, development, and physiology; **Choose species for field guide entries (Google sheet)** |
| 7 | T | 3-7 | **LAB: Stomatal density project – part 1** | **Submit presentation slides** |
| 7 | W | 3-8 | Primary literature presentations | |
| 7 | F | 3-10 | Primary literature presentations | |
| | | | **SPRING BREAK** | |
| **Unit** | **3** | | **Growth & resource acquisition** | |
| 8 | M | 3-20 | Secondary growth: wood | 9-Secondary growth |
| 8 | T | 3-21 | **LAB: Stomatal density project - part 2** | |
| 8 | W | 3-22 | **EXAM II** | |
| 8 | F | 3-24 | Selection project data analysis (bring laptops) | |
| 9 | M | 3-27 | Plant nutrition | 22-Nutrition and nutrients |
| 9 | T | 3-28 | **LAB: Stomatal density project – part 3; Arboretum phenology check** | |
| 9 | W | 3-29 | Material transport in plants | 24-Material movement and diffusion's multiple roles in plant biology |
| **9** | F | 3-31 | Soils | 23-Soils; **Field guide entries due** |
| 10 | M | 4-3 | Mycorrhizae | Organisms: Glomeromycota, pp. 591-592 |
| 10 | T | 4-4 | **LAB: Mendon Ponds field trip** | |

| Week | Day | Date | Topic/activity | Reading/Assignments due* |
|---|---|---|---|---|
| 10 | W | 4-5 | Mycorrhizal networks | |
| 10 | F | 4-7 | Plant-microbe interactions | Organisms: Rhizobium, pp. 739-742 |
| 11 | M | 4-10 | Plant responses to the environment | 26-Interactions involving conditions |
| 11 | T | 4-11 | **LAB: Stomatal density presentations; Arboretum phenology** | **Submit presentation slides, data, & R code by lab time** |
| 11 | W | 4-12 | Invasive species | 29-Weeds and weed control; 30-Threats to agriculture; insects and weeds |
| 11 | F | 4-14 | Invasive species discussion | |
| 12 | M | 4-17 | **EXAM III** | |
| **Unit** | **4** | | **Interactions & services** | |
| 12 | T | 4-18 | **LAB: Stony Brook field trip** | |
| 12 | W | 4-19 | Animal pollination | 27-Biotic interactions |
| 12 | F | 4-21 | Herbivores and plant defense | **Stomatal density lab report draft due** |
| 13 | M | 4-24 | Origin and development of agriculture | 28-Agriculture |
| 13 | T | 4-25 | **LAB: invasive species** | |
| 13 | W | 4-26 | **GREAT DAY – no class** | |
| 13 | F | 4-28 | Agricultural technology | 31-Propagating plants & developing new plants |
| 14 | M | 5-1 | Ethnobotany & drug development | **Final stomatal density lab report due** |
| 14 | T | 5-2 | **LAB: Ganondagan field trip** | |
| 14 | W | 5-3 | Plants & climate change | 29-Weeds and weed control; 30-Threats to agriculture: insects and weeds |
| 14 | F | 5-5 | Plants & climate change | |
| 15 | M | 5-8 | Diversification and speciation | 17-Sex, evolution, and the biological species concept |
| 15 | T | 5-9 | **LAB: Indian Fort spring ephemerals** | |
| 15 | W | 5-10 | TBD | **Phenology report due** |
| | W | 5-17 | **EXAM IV and lab practical; 8 – 11:20 am** | |

**Dates of major assignments and exams** (excludes lab worksheets, in-class activities, online quizzes)
(Note: may require modification if public health situation requires changes in course structure)

| Assignment | Deadline | Details |
|---|---|---|
| Primary literature paper choice due | F, Feb 10 | Include PDF of paper and proper citation |
| Exam I | F, Feb 17 | |
| Primary literature paper analysis due | F, Feb 24 | |
| Choose species for field guide entries | M, Mar 6 | Sign up on Google sheet |
| Submit primary literature presentation slides | T, Mar 7 | Share Google slides or upload PPT by 11:59 pm (regardless of presentation day) |
| Primary literature presentations | W, Mar 8<br>F, Mar 10 | |
| Exam II | W, Mar 22 | |
| Field guide entries due | F, Mar 31 | |
| Stomata density lab presentation & data analysis due | T, Apr 11 | Present in lab, submit data files and R code with slides |
| Exam III | M, Apr 17 | |
| Stomatal density lab report draft due | F, Apr 21 | Submit any revised R code or data files with draft |
| Final stomatal density lab report due | F, May 5 | Submit any revised R code or data files with draft |
| Phenology report due | W, May 10 | |
| Exam IV and lab practical, 8 – 11:20 am | W, May 17 | In ISC 206 |