

Biology 342/542, Vascular Plant Taxonomy

Spring 2013

Grading and Attendance

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Office hours: 10-11 AM on Monday and Wednesday

Vascular plant taxonomy covers a large field. There are over 250,000 species of vascular plants in the world. Only two other groups traditionally covered in advanced university course deal with larger groups - insects and invertebrates. No other group of organisms approaches vascular plants in economic and ecological importance. In part because of the importance of vascular plants to the development of medicine, pharmacology, and agricultural, the volume of literature in plant taxonomy exceeds that of all other organisms combined.

Most students can recognize at least some common trees and wildflowers and can find names for some others in popular field guides before beginning a plant taxonomy course. However, identification of all of the plants of an area requires the ability to use the standard identification manuals which include all of the vascular plants, such as the Gleason and Cronquist *Manual of Vascular Plants of the Northeastern United States and Adjacent Canada* (the popular field guides include 10% or less of the species of this same area). Identification requires knowledge of structures and terms and practice in using the keys.

The ability to name plants in the field also requires a good memory. The key to developing a good memory for plants is learning to group similar plants together. Plant families have proven to be a useful unit. Unlike a person who has learned only some common plants of a local flora, the person who knows the larger plant families can quickly begin learning the local flora of a new area.

The objectives of this course are to develop the knowledge and skills to learn the plants of any area. We will concentrate on learning the flora of Wisconsin, but students are expected to know the most common families of plants worldwide, first by memorizing some key characteristics, then learning them through reinforcement. Students are also expected to develop skill and confidence in keying out unknowns through practice.

Letter grades will be based entirely on the total points accumulated by the student on the following scale based on 580 points in the course:

93% and above,	537 points or more	= A
90-92%,	520-536 points	= A-
88-89%	508-519 points	= B+
83-87%	479-507 points	= B
80-82%	462-478 points	= B-
78-79%	450-461 points	= C+
73-77%	421-449 points	= C

70-72%	404-420 points	= C-
68-69%	392-403 points	= D+
60-67%	346-391 points	= D
below 59.5%	345 points or less	= F

Bonus points earned on the collection count in the above totals, even though it could bring the number of points earned in the course to 605.

There is no "curve" or quota for any letter grade. The grading scale will not be adjusted based on class performance. Cheating will not be tolerated; it is your responsibility to know your academic rights and responsibilities; please read the following link (it is the same for all your other classes here):

<http://www.uwsp.edu/admin/stuaffairs/rights/rightsChap14.pdf>.

The only excuses for missing a lecture exam are 1) illness (doctor's excuse required), 2) serious illness in your immediate family, 3) participation in a scheduled UWSP athletic event, or 4) attendance at a scheduled academic conference or field trip. In the case of 3) and 4), please let me know as far in advance as possible so I can plan on re-scheduling your exam.

Attendance does not figure directly in the grades, but for each lecture exam, I may include up to 10-15% of the questions based solely on material presented in my lectures and not included in the lab manual or text. Also, the amount of material requires regular attendance and students usually need to spend extra time in lab to review for tests and to prepare their collection due at the end of the semester.

The tests include the following:

Exam 1. Introductory material and pteridophytes. 70 points. Thursday 7 Feb. 2013.

Exam 2. Gymnosperms. Structures and terms. 70 points. Thursday 21 Feb. 2013.

Exam 3. Families, genera, and species of the Magnoliidae, Hamamelidae, Caryophyllidae, and Dilleniidae. 100 points. Thursday 21 Mar. 2013.

Exam 4. Families, genera, and species of the Rosidae and Asteridae, excluding the Asteraceae. 100 points. Thursday 19 Apr. 2013.

Exam 5 (Final). Families, genera, and species of the Asteraceae, and the Liliopsida. 100 points. 12:30-2:30 p.m., Monday, 13 May 2013.

Twelve unannounced keying out quizzes will be given during the second hour of most of the labs, beginning on Tuesday, 12 March 2013. Each quiz will be worth 10 points, with 4 points for the flower formula, 2 points for the family, 2 points for the genus, and 2 points for the species. Although you may use any books and notes you wish, all unknowns will be in the Gleason and Cronquist *Manual*, but not necessarily in any other book. There will be no makeup quizzes and you do not have to turn in your quiz. All quizzes turned in will count and the highest total is 100 points. If you are unable to attend several labs because of circumstances beyond your control, you could take some additional quizzes during the other lab section to make up for the some of those you missed.

A collection of 10 specimens must be turned in by 6 pm on Monday, May 13th 2013, to TNR 300. These specimens will not be returned to the student. They must be pressed, dried, and have complete labels. They are to be unmounted, loose (not taped, stapled, or glued) in folded newspapers measuring about 12" X 16," with a collection evaluation sheet on top of the collection. The collection is worth 40 points. Remember that this is primarily an exercise in technique and few, if any, points will be given for poor technique or poor labels. Read carefully the "Plant Collection Techniques and Herbaria" chapter (pages 249-258) in Freckmann *Taxonomy of Vascular Plants*. Note that if the name of the collector, the date, or the place of collection is inaccurate, the collection will not be accepted and the grade will be a zero. Students taking the course for graduate credit (as Biology 542) will be required to turn in 20 specimens.

Up to 10 additional specimens (for a total of 20 collections) may be turned in for 2 bonus points each.

In addition, 10 bonus points will be given if you turn in ALL of your collections by 6 pm on Friday, May 10th, to TNR 300.

Biology 342/542 Vascular Plant Taxonomy

Schedule for Spring 2013

The following schedule is based on an estimate of the time required for each topic, but could be off by a couple of days during the semester. Nevertheless, the exams will probably be given on these dates and should cover the material indicated on this schedule.

The references after each schedule entry consisting of "F" plus page numbers indicate the pages in Freckmann, *Taxonomy of Vascular Plants* that cover the lecture and lab material for that date. This sequence of topics for the angiosperms also follows exactly the sequence in Gleason and Cronquist, *Manual of Vascular Plants, Second Edition*.

Week 1

Jan. 22. (Tuesday lab) "The Myth of the Fully Catalogued Flora". Handouts on course materials, grading, schedules, and plants-to-learn list; plant collection techniques and an explanation of the collection requirement. F235-246.

Jan. 23. Introduction to taxonomy; classification; binomial nomenclature. The species and the species problem; infraspecific taxa. Phylogeny of vascular plants. F1-19, 29-31.

Jan. 24. Construction and use of keys (using winter twigs and conifer boughs). F21-28

Week 2

Jan. 28. Fern allies (Rhyniophyta through Equisetophyta). F31-38.

Jan. 29. Fern allies (Rhyniophyta through Equisetophyta).

Jan. 30. Polypodiophyta (ferns). F39-48.

Jan. 31. Morphology and identification of pteridophytes (ferns and fern allies).

Week 3

Feb. 4. Start Gymnosperms. F48-55.

Feb. 5. Morphology and identification of gymnosperms.

Feb. 6 (Tuesday). Exam 1: Lecture and lab exam on introductory material and pteridophytes (70 points).

Feb. 7. Finish Gymnosperms. Introduction to angiosperms (Magnoliophyta). F56-60.

Week 4

Feb. 11. Vegetative structures and terms. Inflorescences. F61-72.

Feb. 12. Finish morphology and identification of gymnosperms. F56-60.

Feb. 13. Structures and terms for flowers. Fruit types. F76-86.

Feb. 14. Vegetative structures and terms. Inflorescences. F61-72.

Week 5

Feb. 18. Begin Magnoliopsida and Magnoliidae (Magnoliaceae through regular-flowered Ranunculaceae). F87-99.

Feb. 19. Flowers. Floral formulas. Fruit types. F76-86.

Feb. 20. Finish Magnoliidae (from irregular-flowered Ranunculaceae); Begin Hamamelidae (through Moraceae). F99-108.

Feb. 21 (Thursday). Exam II: Lecture and lab exam on gymnosperms and structures and terms of angiosperms (70 points).

Week 6

Feb. 25. Finish Hamamelidae (starting with Juglandaceae). Begin Caryophyllidae (through Aizoaceae). F109-117.

Feb. 26. 1. Begin Magnoliidae.

Feb. 27. Continue Caryophyllidae (Cactaceae through Caryophyllaceae). F117-123.

Feb. 28. Magnoliidae. Practice keying out unknowns.

Week 7

Mar. 4. Finish Caryophyllidae. Begin Dilleniidae (through Droseraceae). F124-132.

Mar. 5. Hamamelidae.

Mar. 6. Continue Dilleniidae (Passifloraceae through Salicaceae). F134-137.

Mar. 7. Begin Caryophyllidae.

Week 8

Mar. 11. Continue Dilleniidae (Brassicaceae through Ericaceae). F138-142.

Mar. 12. Finish Caryophyllidae, begin Dilleniidae. **Begin keying out quizzes.** (Note: There will be a 10 point keying out quiz during the last 45 minutes of every regular lab from this day through the end of the semester).

Mar. 13. Finish Dilleniidae. Begin Rosidae (through Saxifragaceae). F140-150.

Mar. 14. Finish Dilleniidae.

Week 9

Mar. 18. Continue Rosidae (Rosaceae through Caesalpiniaceae). F150-156.

Mar. 19. Begin Rosidae.

Mar. 20. Continue Rosidae (Fabaceae through Cornaceae). F157-164.

Mar. 21 (Thursday). EXAM III: Lecture and lab exam on the families, genera, and species from the plants-to-learn list for the Magnoliidae, Hamamelidae, Caryophyllidae, and Dilleniidae (100 points).

SPRING BREAK, 23-31 March 2013 – GO SOMEPLACE WARM AND COLLECT PLANTS!

Week 10

Apr. 1. Continue Rosidae (Santalaceae through Aceraceae). F165-174.

Apr. 2. Continue Rosidae

Apr. 3. Finish Rosidae (Anacardiaceae through Apiaceae). F175-183.

Apr. 4. Continue Rosidae.

Week 11

Apr. 8. Begin Asteridae (Gentianaceae through Hydrophyllaceae). F184-191.

Apr. 9. Finish Rosidae.

Apr. 10. Continue Asteridae (Boraginaceae through Scrophulariaceae). F192-199.

Apr. 11. Begin Asteridae.

Week 12

Apr. 15. Continue Asteridae (Orobanchaceae through Dipsacaceae). F200-207.

Apr. 16. Asteraceae (Asteridae).

Apr. 17. Asteridae (Asteraceae). F207-211.

Apr. 18 (Thursday). EXAM IV: Lecture and lab exam on the Rosidae and Asteridae except the Asteraceae (100 points).

Week 13

Apr. 22. Begin Liliopsida (Alismataceae through Xyridaceae). F212-223.

Apr. 23. Begin Liliopsida.

Apr. 24. Continue Liliopsida (Commelinidae through Poaceae structure). F224-230.

Apr. 25. Continue Liliopsida.

Week 14

Apr. 29. Continue Liliopsida (finish Poaceae through Bromeliaceae). F230-236.

Apr. 30. Continue Liliopsida.

May 1. Continue Liliopsida (Strelitziaceae through Agavaceae). F236-243.

May 2. Continue Liliopsida.

Week 15

May 6. Continue Liliopsida (Smilacaceae through Orchidaceae). F243-248.

May 7. Field trip (mandatory) to Wisconsin River bottoms in Stevens Point. Transportation will be provided.

May 8. Spring Flora of Wisconsin. Last class day.

May 9. Finish Liliopsida

Week 16 - Finals week

May 10 (Friday): Last day to earn 10 bonus points by turning in ALL of your labeled plant collections by 6 pm in TNR 300.

May 13 (Monday): 12:30-2:30 pm. - Lecture and lab final on Asteraceae, Liliopsida, and the spring flora. Half the group will meet in the lecture hall, TNR 120 at 8:00 a.m. and the other half in the lab, TNR 300; both groups will switch at 9:00 a.m.

May 13 (Monday): Final deadline for plant collections, due in TNR 300 by 6 pm.

BIOLOGY 342/542 BOOKS, MATERIALS, WEBSITES

Books from Text Rental

Text and reference: Michael G. Simpson, *Plant Systematics*, 2006.

Lab Manual and Identification Reference: Gleason and Cronquist, *Manual of Vascular Plants of Northeastern United States and Adjacent Canada, Second Edition*. 1992.

Required Purchase

Freckmann, Robert F., *The Taxonomy of Vascular Plants, A Text to Accompany the Second Edition of Gleason and Cronquist Manual of Vascular Plants, 2000 edition*.

Useful Books (not required)

Woody Plants – Trees, Shrubs and Woody Vines

Trees and Shrubs of Minnesota. Welby Smith. University of Minnesota Press, 2009. 640 pp. Outstanding book that will be the standard in for years. This guide will cover 99% of all woody species in western and northern Wisconsin, perhaps 90-95% in southeastern Wisconsin. The author does an excellent job of even difficult groups that no other guide will touch – willows, hawthorns, brambles, and juneberries. Get this guide for woody plants. \$40.46.

Best website: Trees of Wisconsin by Gary Fewless, UW-Green Bay:

http://www.uwgb.edu/biodiversity/herbarium/trees/tree_intro01.htm

..and Shrubs of Wisconsin by Gary:

http://www.uwgb.edu/biodiversity/herbarium/shrubs/Shrub_intro01.htm

Ferns and Fern Allies (Pteridophytes)

Again, there is no good regional guide and really no satisfactory national guide. Best (though way out date) is *Ferns and Fern Allies of Minnesota* by Rolla Tryon, 1954 Univ. Minnesota Press.

Best website: Pteridophytes of Wisconsin by Gary Fewless, UW-Green Bay:

http://www.uwgb.edu/biodiversity/herbarium/pteridophytes/pteridophytes_of_wisconsin01.htm

Wildflowers

Wildflowers of Wisconsin and the Great Lakes Region. 2nd edition. Merel R. Black & E.J. Judziewicz. University of Wisconsin Press, 2009. \$19.77.

Best website: Ours! Plants of Wisconsin

(<http://wisplants.uwsp.edu/VascularPlants.html>). 2,952 distribution maps; 7,872 pictures of 2,638 species; checklist of Wisconsin plants; plant communities of Wisconsin; news events; botany links.

Wisconsin Vascular Plants (UW-Madison) (<http://www.botany.wisc.edu/herbarium/>) distribution maps, pictures; checklist of Wisconsin plants; prairie and savanna atlas; news events; botany links.

USDA Plants Database (<http://plants.usda.gov/>): Searchable information on 20,000 U.S. plant species, many with images; links to state websites.

Angiosperm Phylogeny Website (<http://www.mobot.org/mobot/research/APweb>). A consensus-based evolutionary tree of the flowering plant families. Frequently updated.

Spring Flora of Wisconsin. Olive Thomson, 1976. Univ. Wisconsin Press. Guide to all flowers in bloom before June 15th. Very useful, but only partly illustrated by line drawings. Also nice: Keys to about ¾ of Wisconsin's species of *Carex*. \$19.95.

Flora of the Chicago Region, by Floyd Swink & Gerould Wilhelm. 3rd edition, 1994. Very useful throughout southern Wisconsin, probably covering 98% of the species present from the Madison area on south. Keys and extensive habitat and associate information, but no pictures. Now out of print, Amazon lists used copies for \$94.00.

Prairie Plants of the University of Wisconsin-Madison Arboretum. Theodore S. Cochrane, Kandis Elliot & Claudia Lipke. 2006. University of Wisconsin Press. Superb content and graphics covering 360 species. Applicable to prairie, old field, wetland, savanna, and barrens communities throughout the state. \$25.55.

Atlas of the Wisconsin Prairie and Savanna Flora. 2000. T.S. Cochrane and Hugh Iltis. Wisconsin DNR Technical Bulletin 191. Excellent habitat data, maps, and discussion of Wisconsin prairie communities.

Michigan Flora, Vol. I-III. 1972-1995. Edward G. Voss. Cranbrook Institute of Science. This outstanding inexpensive (\$20.00 for each volume) set has excellent keys (including to aquatic macrophytes and graminoids) and will cover about 95% of the species that in northern Wisconsin (dropping to about 90% or less in southern Wisconsin). Downsides: Pteridophytes not included; not many illustrations; habitat data a bit weak. Will be republished in the coming years as an updated, 1-volume handbook.

Useful Regional Floras

Holmgren, *Illustrated Companion to Gleason & Cronquist's Manual*. \$125.00. If you are going to be doing any serious plant identification in your career, this book is highly recommended.

Voss, E.G. *Michigan Flora* (3 volumes, \$15.00 each – a real bargain). Useful except in SW Wisconsin. Keys, some pictures. Excellent for aquatics, grasses, and sedges.

Graminoids (Grasses, Sedges and Rushes)

Best website: Grasses of Iowa (<http://www.eeob.iastate.edu/research/iowagrasses/>).

Field Guide to Wisconsin Sedges. Andrew Hipp et al. 2008. Univ. of Wisconsin Press. Keys and distribution maps to all of Wisconsin's 157 species of *Carex*; illustrations of 50-70 species. \$20.40.

Ed Voss' "Flora of Michigan" Vol. I is also highly recommended for graminoids.

Grasses of Wisconsin. Norman C. Fassett. 1950. Univ. of Wisconsin Press. The nomenclature is way out of date and pictures somewhat crude... And new native and invasive species have been found since 1950.

Manual of the Grasses for North America. 2007. Mary Barkworth et al. Intermountain Herbarium and Utah State University Press. Beware of this book. The keys to genera are almost unusable, even by professionals; tiny maps, many inaccurate. Good points (many): All species are illustrated; modern nomenclature.

Aquatic Macrophytes

Aquatic Plants of Wisconsin: A Photographic Field Guide to Submerged and Floating-Leaf Aquatic Plants. 2010. Paul M. Skawinski. Excellent color photos of nearly all Wisconsin aquatic macrophytes; highly recommended. \$30.00. Available from the author: Lakeplants@yahoo.com or from <http://www.wisconsinlakes.org/books.htm> or <http://www.uwsp.edu/cnr/uwexplakes/publications/>.

Aquatic and Wetland Plants of Northeastern North America. Vols. 1-2. Garrett Crow and Barre Hellquist. 2000. Univ. of Wisconsin Press. "Supercedes" the much better, more concise, more compact Norman C. Fassett's "A Manual of Aquatic Plants" (UW-Press 1957) – get the older book if you can. Line drawings only, no color or photos.

Invasive Plants

Invasive Plants of the Upper Midwest: An Illustrated Guide to Their Identification and Control. 2005. Elizabeth Czarapata. Univ. of Wisconsin Press. \$26.95.

Equipment

A dissecting kit of at least two sharp needles, one forceps, and a mm ruler. Dissecting kits can be checked out from the Biology stockroom, TNR 193C, for the semester.

A hand lens, 10-15X, is quite useful, but not required. Good hand lenses are available from the Museum of Natural History sales counter in the Library.

A plant press can be checked out for two weeks from the Biology stockroom (TNR193C).

Biology 342/542, Spring 2013

PLANTS TO LEARN LIST

Learn to recognize the following families, genera, and species for sight recognition (without books or notes) on the lab portions of the major tests. You should learn the scientific names, although you may substitute the common names given on this list for up to one-third of your answers. The material on the lab exam will be live material (either recently collected or grown in the greenhouse) whenever possible. Otherwise the material will consist of pressed specimens, sometimes with drawings, photographs, pickled material, or thawed frozen material. Because these materials will not be the same specimens or photographs used in the study sets (and in the case of families or genera for recognition, they may not be the same species), you should learn to recognize these taxa by their main taxonomic features (such as flower formulas, fruit type, etc.). There will usually be material available for dissection or observation under the microscope during the exam for specimens that need this type of observation.

Specimens of each family, genus, or genus and species on this list will be on demonstration during the regular scheduled lab covering the unit and will remain on demonstration until the next lab is set up. A study set of specimens will be posted in the hall display cases until the exam over the unit. Slides of most of the plants on the list are available on the internet on the Plants of Wisconsin website at <http://wisplants.uwsp.edu/VascularPlants.html>. No materials may be removed from the lab.

The lab is usually open at all times, including weekends if you can get into the building (usually at least one door is unlocked on Saturdays). Copies of old lecture exams are posted in the Biol. 342 course public folders on D2L.

First Exam

The first exam will be given in lab on **Thursday, Feb. 7** and will count for 70 points out of the 600 total points for the course. A small portion of the test will cover the introductory lecture material on Linnaeus, classification, the nature of genera and species, etc. Most of the test will cover the pteridophytes (Rhyniophyta, Lycopodiophyta, Equisetophyta, and Polypodiophyta); **up to 10-15% of the lecture exam may come from material covered only in lecture and not necessarily in the textbook, lab manual, or course intranet folder.** The lab portion may cover some terms and structures (e.g. the parts of a fern), but will emphasize sight recognition of the genera and species of pteridophytes on the following list.

PTERIDOPHYTES

Lycopodium clubmosses or ground pines
Huperzia shining clubmosses

Diphasiastrum ground cedar clubmosses
Selaginella spikemoss
Isoetes quillwort
Equisetum horsetail
Equisetum arvense field horsetail
Equisetum hyemale scouring-rush
Osmunda claytoniana interrupted fern
Osmunda cinnamomea cinnamon fern
Osmunda regalis royal fern
Botrychium grape fern, moonwort
Gymnocarpium oak fern
Dryopteris shield fern, wood fern
Athyrium lady fern
Polypodium polypody fern
Pteridium bracken fern
Adiantum maidenhair fern
Onoclea sensitive fern
Matteuccia ostrich fern

Second Exam.

The second exam, worth 70 points, will be given in lab on **Thursday, Feb. 21**. It will cover structures and terms, but will not require writing flower formulas. Much of the lab part of the test (50 points) will be given from slides and you will be asked for the term or terms to describe the root system, stem modification, leaf arrangement, other leaf features, inflorescence type, flower characters, fruit type, etc. There will be sight identification of the gymnosperms on the list below. The lecture portion of this exam will be short (20 points) and cover only the Gymnosperms (Pinophyta, Cordaitopsida, Ginkgopsida, Pinopsida, Pinales, Pinaceae, Taxodiaceae, Cupressaceae, Lyginopteridopsida, Bennettitopsida, Cycadopsida, and Gnetopsida); up to 10-15% of the lecture exam may come from material covered only in lecture and not necessarily in the textbook, lab manual, or course intranet folder.

GYMNOSPERMS

Taxus yew
Pinus pine
Pinus strobus eastern white pine
Pinus resinosa red pine
Pinus banksiana jack pine
Pinus sylvestris Scotch pine
Abies fir
Picea spruce
Picea glauca white spruce
Picea mariana black spruce
Picea abies Norway spruce
Picea pungens Colorado blue spruce
Tsuga hemlock
Pseudotsuga douglasfir

Larix tamarack, larch
Juniperus juniper
Juniperus communis common juniper
Juniperus virginiana red cedar
Thuja white cedar, arbor vitae
Ephedra Mormon-tea or joint-fir
Ginkgo ginkgo or maidenhair tree

Third Exam

This exam will be given in lab on **Thursday, Mar. 21** and will count for 100 points, with about 45 points from the lab portion and 55 from the lecture portion. The lab part of the test will be given during the first hour. It will consist primarily of sight recognition of the families, genera, and species listed below. The lecture portion will cover only the families of the Magnoliidae, Hamamelidae, Caryophyllidae, and Dilleniidae on the list below; up to 10-15% of the lecture exam may come from material covered only in lecture and not necessarily in the textbook, lab manual, or course intranet folder. You should know the main taxonomic characteristics of each family on this list, the relative size, distribution, ecological and economic importance of each, and some of the major components.

Families (lecture and lab):

Magnoliaceae	Magnolia Family
Ranunculaceae	Buttercup Family
Papaveraceae	Poppy Family
Moraceae	Mulberry Family
Urticaceae	Nettle Family
Cactaceae	Cactus Family
Chenopodiaceae	Goosefoot Family
Amaranthaceae	Amaranth Family
Caryophyllaceae	Pink Family
Polygonaceae	Smartweed Family
Malvaceae	Mallow Family
Cucurbitaceae	Gourd Family
Brassicaceae	Mustard Family
Ericaceae	Heath Family
Primulaceae	Primrose Family

Genera and species (lab portion of exam only):

Nuphar yellow pond-lily, bull-lily
Nymphaea water-lily
Ulmus elm
Celtis hackberry
Juglans walnut, butternut
Carya hickory
Fagus beech
Quercus oak

Quercus alba white oak
Quercus macrocarpa bur oak
Quercus rubra northern red oak
Quercus ellipsoidalis northern pin oak, Hill's oak
Corylus hazelnut
Ostrya ironwood, hop-hornbeam
Carpinus blue-beech, hornbeam, musclewood [not ironwood]
Betula birch
Betula alleghaniensis (*B. lutea*) yellow birch
Betula nigra river birch, red birch
Betula papyrifera paper birch
Alnus alder
Tilia basswood, linden
Sarracenia pitcher-plant
Drosera sundew
Alliaria garlic mustard
Salix willow
Populus grandidentata big-toothed aspen
Populus tremuloides trembling aspen, quaking aspen, popple
Populus deltoides cottonwood
Populus balsamifera balsam-poplar

Fourth Exam

This exam will be given in lab on **Thursday, Apr. 18** and will also count for 100 points. The format, coverage, and point distribution will be similar to the third exam, except that the unit covered is the Rosidae and Asteridae, excluding the Asteraceae. The lecture portion of the test will cover only the families listed below; up to 10-15% of the lecture exam may come from material covered only in lecture and not necessarily in the textbook, lab manual, or course intranet folder. The lab portion will cover these families as well as the genera and species listed below.

Families (lecture and lab):

Crassulaceae	Stonecrop Family
Rosaceae	Rose Family
Mimosaceae	Mimosa Family
Caesalpiniaceae	Caesalpinia Family
Fabaceae	Bean Family
Onagraceae	Evening-primrose Family
Myrtaceae	Myrtle Family
Euphorbiaceae	Spurge Family
Araliaceae	Ginseng Family
Apiaceae	Carrot Family
Asclepiadaceae	Milkweed Family
Solanaceae	Nightshade Family
Boraginaceae	Borage Family
Lamiaceae	Mint Family
Scrophulariaceae	Figwort Family

Campanulaceae Bellflower Family
Rubiaceae Madder Family

Genera and species (lab portion of exam only):

Ribes currant, gooseberry
Rubus bramble, blackberry, raspberry, dewberry
Rosa rose
Prunus cherry, plum, peach, apricot
Crataegus hawthorn
Robinia black locust
Trifolium clover
Melilotus sweet-clover
Medicago alfalfa
Lythrum purple loosestrife
Cornus dogwood, bunchberry
Rhamnus cathartica common buckthorn
Rhamnus frangula glossy buckthorn
Acer maple
Acer saccharum sugar maple
Acer rubrum red maple
Acer saccharinum silver maple
Acer negundo box-elder
Rhus sumac
Toxicodendron poison-ivy, poison-sumac
Plantago plantain
Fraxinus americana white ash
Fraxinus nigra black ash
Fraxinus pennsylvanica green (or red) ash
Galium bedstraw
Lonicera honeysuckle
Sambucus elderberry
Viburnum viburnum, nannyberry, high-bush cranberry

Fifth (Final) Exam

This exam is worth 100 points and will be given from **12:30-2:30 p.m. on Monday, May 13**, with half of you (A-L) meeting in the lecture hall, TNR 120 and the other half (M-Z) in the lab, TNR 300. The groups will switch at about 1:30 p.m. The lecture portion will cover the families of the Liliopsida (Monocots) listed below and the Asteraceae; up to 10-15% of the lecture exam may come from material covered only in lecture and not necessarily in the textbook, lab manual, or course intranet folder. The lab portion will include some structures and sight recognition of the families, genera, and genera and species on the list, including some representatives of the spring flora.

Families (lecture and lab):

Asteraceae Aster Family
Alismataceae Water-plantain Family

Arecaceae	Palm Family
Araceae	Arum (Calla-lily) Family
Lemnaceae	Duckweed Family
Commelinaceae	Spiderwort Family
Juncaceae	Rush Family
Cyperaceae	Sedge Family
Poaceae	Grass Family
Bromeliaceae	Bromeliad (Pineapple) Family
Liliaceae	Lily Family
Iridaceae	Iris Family
Orchidaceae	Orchid Family

Genera and species (Lab portion of exam only):

Helianthus sunflower
Ambrosia ragweed
Solidago goldenrod
Aster aster
Liatris blazing-star
Eupatorium Joe-pye-weed, boneset, white snakeroot
Centaurea maculosa (*C. biebersteinii*, *C. stoebe*) spotted knapweed
Cirsium thistle
Hieracium hawkweed
Arisaema jack-in-the-pulpit
Carex sedge
Avena oats
Triticum wheat
Secale rye
Phragmites giant reed
Andropogon bluestem
Typha cattail
Cypripedium lady-slipper, moccasin-flower

SPRING FLORA

Caltha marsh-marigold
Ranunculus buttercup, crowfoot
Dicentra Dutchman's breeches, bleeding-heart
Claytonia spring-beauty
Barbarea yellow rocket
Capsella shepherd's purse
Viola violet, pansy
Fragaria strawberry
Taraxacum dandelion
Symplocarpus skunk-cabbage
Luzula wood rush
Trillium trillium

TERMS TO KNOW

Annual
Biennial
Perennial
Tap root
Fibrous root
Adventitious roots

Blade
Leaflet
Petiole
Stipule
Thorn
Spine
Prickle

Bulb
Corm
Rhizome
Stolon
Whorled
Opposite
Alternate
Basal Rosette
Cauline leaves
Pinnately compound
Palmately compound
Parallel venation
Net venation

Linear
Lanceolate
Ovate
Elliptical
Obovate
Oblanceolate
Orbicular
Acuminate
Acute
Obtuse or rounded
Truncate
Cuneate
Cordate
Oblique
Entire
Serrate
Dentate
Crenate
Lobed

Glabrous
Glaucous
Glandular
Stellate

Scabrous
Hispid
Pubescent
Puberulent
Pilose
Tomentose

Scape
Peduncle
Pedicel
Dichasial cyme or dichasium
Scorpioid cyme or monochasial cyme

Axillary
Raceme
Spike
Spathe
Spadix
Catkin
Umbel
Compound umbel
Head
Panicle
Receptacle

Perianth
Calyx
Sepal
Corolla
Petal
Tepal

Monoecious
Dioecious
Perfect-flowered
Actinomorphic or regular or radially symmetrical
Zygomorphic or irregular or bilaterally symmetrical

Androecium
Stamen
Filament
Anther

Gynoecium
Pistil
Carpel
Ovary
Superior Ovary
Inferior Ovary
Hypanthium
Stigma
Style
Locule
Placenta or region of placentation
Axile placentation
Parietal placentation

Berry
Pepo
Pome
Hesperidium
Drupe
Follicle
Legume
Capsule
Silique
Schizocarp
Nut
Achene
Caryopsis
Samara
Complex fruit
Aggregate fruit
Accessory fruit
Multiple fruit