Plant Ecology (PCB3601C) Spring 2020

Lead Instructor:

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Laboratory Instructors:

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Mackenzie A. Smith: e-mail: mackenziesmith@ufl.edu; Office: 210 Dickinson Hall; 503 403 8941; Research Interests: Paleobotany, paleoecology.

Course Website: Go to E-Learning (http://lss.at.ufl.edu/) & login to e-learning in Canvas with your Gator Link ID. Reading quizzes must be taken on Canvas BEFORE the class/lab meeting unless otherwise announced during the class. Updates to schedules & supplementary readings will be posted on this website along with copies of other course-related communications sent to you via e-mail. Be sure that you are receiving these messages (several sent even before classes commenced).

Course Description: This course introduces ecology as a scientific discipline with emphasis on Floridian plants & ecosystems. By the end of the course, students should be familiar with ecological principles related to how plant populations & communities interact with their environments at local, regional, & global scales. The labs emphasize the ability to recognize common plants, vegetation types & ecosystems of the region while they introduce students to hypothesis testing and scientific reporting through field experiments, manuscripts, posters, and oral presentations.

Lectures: Tuesday & Thursday, Period 5, 11:45-12:35 in CLB-C130

Labs: Periods 6-9, 12:50-4:55 PM. 114 Rolf Hall on either Monday (section 7425, class #17380), Tuesday (sections 27GB, class # 17379), or Wednesday (section 8223 class #17382). For field labs specified as "Field" in the syllabus, meet at the specified location at the specified time. We often depart from the parking lot behind Bartram/Carr Halls, but be sure to check your syllabus. We will try to return to campus on time, but provisions should be made in case we fail to do so. Normal (M,T,W) field trips start promptly at 12:50 (so get there a few minutes early). The two Friday trips depart from behind Bartram/Carr Halls sharply at 9:30 AM.

NOTE THAT THERE WILL ALSO BE TWO MOST-OF-THE-DAY **FRIDAY** OR **SATURDAY** FIELD TRIPS (IN LIEU OF OTHER LABS DURING THOSE WEEKS) FOR WHICH THERE ARE OPTIONS FOR ANYONE WHO REALLY CANNOT ATTEND

Required and Recommended Books, Supplies, and Tools

REQUIRED: **Plant Ecology Syllabus and Lab Manual** [available during the first week of classes at Target Copy at 1412 West University Avenue (352 376 3826) for about $14].

REQUIRED: A bound field notebook specific for this course. We recommend that you obtain a field-book with waterproof paper such as the Elan e-64 soft-cover with 50 pages.

RECOMMENDED HIGHLY: Shimel, J. 2012. Writing Science. Alternatively, you can always use Strunk, W. and E.B. White. 2000. The Elements of Style. Note that the focus of this course is on Science, but that focus includes the ability to communicate about Science effectively.
RECOMMENDED: A 10-20X hand lens (=loope = magnifying glass).
RECOMMENDED: Finding Home in the Sandy Lands of the South by F.E. Putz, available at Amazon, on Kindle, & at the Florida Museum of Natural History Book Store.

Required Software: CMAP, WORD, POWERPOINT, & EXCEL (with statistics add on).

Pedagogical Approach (including reading requirements): This course is designed to reflect current research on learning. In particular, this pedagogical research (i.e., studies on the science of teaching) reveals that students (both strong & not-so-strong) learn better when they work in cooperative groups & when they have opportunities to discover information for themselves that is relevant to their own lives. Interestingly, although the benefits from active learning are clear, many students mistakingly self-report that they learn more from lectures (e.g., Deslauriers et al. 2019. PNAS). To foster learning, therefore, inquiry-based activities are extensively used in this course. Our mostly inquiry-based learning looks remarkably like the scientific method. Labs and lectures begin before you report for your session—in preparation for each, you will typically be asked to learn enough about a process, phenomenon, or species to introduce that topic to your classmates, generally while in the field (see below for further explanation). You may also be asked to answer questions or reflect on a situation described in the lab or other reading materials assigned for that week, as quizes to be submitted on-line before your scheduled lab or the lecture. During most labs, you will formulate hypotheses, design experiments, carry out experiments, analyze data, reach conclusions, & suggest modifications to experiments. Although this creative & iterative process is at the heart of Science, it is too often disregarded to the point that Science seems like boring drudgework and meaningless memorization.

A prerequisite for effective "active learning" is that class participants come to each session prepared. This preparation can involve reading the materials (or watching the videos) to be provided as well as digging up information on your own about the assigned topics. In recognition that all class participants have conflicting demands on their time, in addition to your inherent thirst for ecological knowledge, thorough pre-class preparation will be motivated by pre-"class" quizzes (often on-line) that will weigh heavily in the calculation of course grades not to mention the peer pressure from shared responsibilities for learning). There's also solid evidence that the process of note-taking enhances learning, so be prepared to take notes starting in the first class.

Given that every group of learners is different & our approach to teaching constantly evolves, often in a saltatory manner, the syllabus is not specific about the number of assignments nor the natures of all of them. This vagueness will allow the instructors to respond to perceived needs in an adaptive manner. For example, if many class members are struggling with a topic or concept, additional time & possibly assignments might be assigned to help alleviate the learning impediments.

More Specifically: In keeping with the findings of pedagogical studies, active-learning approaches will be employed as much as possible in this course. Such an approach requires that participants come to each class session (i.e., lectures and labs) prepared to participate/contribute/share. To that end, you will often be assigned a topic to "research" in advance; during lecture or lab you will share your knowledge with the other participants. In many cases, this knowledge will pertain to a particular species, chosen for their ecological importance, commonness, usefulness, or any of a variety of peculiarities that tickled the fancy of your guides.

Accumulation of knowledge sufficient to share about your assigned topic/species/process should take no more than 30-45 minutes of Googling, reading, and other sorts of intellectual exploration that should be fun and interesting. You should (always) start with the relevant section in "Finding Home in the Sandy Lands of the South;" you are always welcome to visit your guide's office in your quest for additional materials. You might bring to the class some pictures or other illustrative material to supplement your verbal presentation (no more than a few minutes), which will occur at the appropriate time, such as when we first encounter your species/process in the field.

Over-Arching Learning Goals: To understand how local plant populations and communities are affected by natural and anthropogenic environmental factors through lectures, discussions, and hands-on experience with the scientific processes of hypothesis formulation, experimental design, data analysis and interpretation, and written and oral presentation of research results.

Underlying Theme: Importance of plants for sustainable resource use and maintenance of hospitable environments for humans & other organisms.
Paleoecology>Climatology>Physiology>Biogeochemistry>Community Ecology>Conservation

Key Concepts & Learning Objectives

1. **Biogeography**: geological history of the biosphere (with local emphasis); global & regional patterns of plant species & life form diversity.
   - *Learning objective assessment*: Ability to describe global & local biogeographical regions as well as the major paleoecological events (e.g., continental drift & climate change) responsible for their development.
2. **Climate & Climate Change**: physics of climatological phenomena; global climate drivers; climate diagrams; past & on-going climate change.
   - *Learning objective assessment*: Ability to explain regional climate patterns from basic physical principles, global atmospheric circulation patterns, ocean currents, & distributions of continents & major mountain ranges.
3. **Resources & Productivity**: above & below ground resource acquisition & use; mycorrhizae; photosynthetic light utilization by leaves, whole plants, & vegetation; CO_2 limitation on photosynthesis; O_2 limitations on respiration; water-use efficiency.
   - *Learning objective assessment*: Ability to explain how environmental factors influence net photosynthesis & ecosystem productivity using graphs & concept maps.
4. **Populations, Communities, & Landscapes**: structures & dynamics of plant populations & communities; life histories; competition; disturbance (especially fire); stress (especially fire suppression & flooding); succession; regeneration; invasive exotic species.
   - *Learning objective assessment*: Ability to explain how population & community dynamics of plants are influenced by disturbance, stress, & species interactions.
5. **Biogeochemistry (Nitrogen, Phosphorus, Carbon, & Water Cycles):** soil structure & formation; nutrient cycles; anthropogenic effects (e.g., increased nitrogen deposition); mitigation & adaptation to climate change.
   - *Learning objective assessment*: Ability to explain natural & anthropogenic factors that influence soil types, mineral nutrient availability, & plant community characteristics.

6. **Global Change, Biodiversity & Conservation**: climate-change impacts, land-use change, fragmentation & edge effects, conservation strategies, biofuels, urban ecology, & human "footprints," life in the Anthropocene.
   - *Learning objective assessment:* Ability to explain trade-offs involved in biodiversity conservation, economic development, & mitigation of climate change.
7. **Scientific Method**: formulation of falsifiable hypotheses, experimental design, data graphing, basic statistics, avoidance of bias, benefits of replication, minimum sample size determination (based on variances and minimum detectable differences), and power.
- *Learning objective assessment:* Ability to formulate novel hypotheses, design experimental protocols to falsify those hypotheses, graph/analyze/interpret results, and present studies in oral and written forms in manners appropriate for science.
8. **Restoration Ecology and Invasive Exotic Species**: different approaches to restoration/reforestation/reclamation; restoration as a redemptive opportunity for destruction; invasiveness vs. invasibility.
-*Learning objective assessment:* Recognize some of the pros and cons of different approaches to ecological restoration; understand the factors that govern the invasibility of communities and the invasiveness of species.

Grading:

"Lecture" (including exams, quizzes, in class assignments, evidence of preparedness, take-home assignments): 60%

Lab (including weekly assignments, evidence of preparedness, research papers, plant collection, poster, lab practical, etc.): 40%

A large portion of your lab grade will be based on your independent research on fire ecology (an oral presentation and two submissions of a written manuscript) and edge effects (a poster presentation).

Your grade will be calculated as follows: 94-100% A; 90-93% A-; 87-89% B+; 83-86% B; 80-82% B-; 77-79% C+; 73-76% C; 70-72% C-; 67-69% D+; 63-66% D; 60-62% D-; 0-59% E

Grades will be rounded to the nearest whole point (e.g. 89.5 = 90, 89.49 = 89)

Information on current UF grading policies for assigning grade points can be found at: https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

*Remember that the time to improve your grade is during the semester, not after final grades are calculated. Grades will only be changed at the end of the semester if there were calculation errors.

Special Assignments (note there will be many more):

Self-portrait with plant: To help your instructors to learn the names of class participants, submit a digital photograph of yourself with a plant you feel represents you. Your picture should include your selected plant species either as a sample in your hand or as the backdrop to your portrait and a legible sign with your name. You will submit your portrait to Canvas and include a message in which you identify the species portrayed (common names will suffice this early in the semester but not afterwards), why you feel it represents you, and one natural history observation about that species. For example, you might have your picture taken in front of a camphor tree (*Cinnamomum camphora*) and point out in your message that its crushed leaves smell like a mentholated chest poultice (e.g., Vick's Vapo-rub). Before your second lab, which will be held during the second week of the semester, send your picture as an e-mail attachment to both your laboratory instructor and fep@ufl.edu.

Plant collection: Learning to "read" a landscape requires knowing the main species. To foster your ability to recognize plant species and understand their roles in communities, you are required to submit a

collection of 48 native plant species and 2 invasive exotics. The exotics and at least 10 natives need to be represented by actual leaves with twigs, but the rest of the collection can be digital (i.e., original photographs) or artistic (e.g., recognizable line drawings, ink impressions, or etc.), but each depiction or collection must be your own (and identifiable as such)—no downloaded images will be accepted. Each sample, regardless of its type, should be identified to species (Latin binomial and vernacular name), its taxonomic family noted, its growth form described (at least tree, shrub, vine, herb, or graminoid), its habitat briefly described, and two distinctive characteristics noted.

Notes on Attendance and Related Issues:

1. Quizzes will be administered mostly on our e-learning site and are often due 1 hour before the scheduled class. No makeups will be allowed.
2. Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies (https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx).
3. Some assignments will be accepted late but, without appropriate excuse, the grades will be reduced somewhat.
4. Make-up exams will be administered to students with legitimate and documented excuses submitted to the instructor in advance (or at the earliest date possible in case of serious illness). The makeup exam will be given only at a later date, likely with more challenging content and in a different format.
5. If you miss a lab for an acceptable reason (e.g., health issues or course conflict), arrange with your laboratory instructor for a make-up activity in advance or as soon as possible afterwards to receive credit.
6. Students with disabilities requesting classroom accommodation should register with the Disability Resource Center (352-392-8565, www.dso.ufl.edu/drc/), which will provide documentation that should be given to the instructor when requesting accommodation.

Academic Honesty: All students registered at the University of Florida have agreed to comply with the Honor Pledge, which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code". Furthermore, on all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. You are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class. Written assignments will be assessed using the internet-based anti-plagiarism software Turnitin, a web-based program that is able to identify matching and partially altered phrases from web content and Turnitin databases, allowing for the evaluation of proper and improper citation as well as for dishonest plagiarism.

Student Complaint Process: If you want to complain about this course in an official manner, please use this website: https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf.

Online Course Evaluation Process: Students should provide feedback on the quality of instruction in this course by completing online evaluations at https://evaluations.ufl.edu. Evaluations are typically open during the last week of the semester. **If >80% of your classmates submit their evaluations**, 1 percentage point will be added to all grades, so do exert some peer pressure. Summary results of these assessments are available at https://evaluations.ufl.edu/results/.

Field Trip Preparation:

Listed below are the tools required (1-6) or recommended (7-13) every time we go to the field in lab.

1. **Long pants** (first line of defense against catbrier vines, snakes, chiggers, and ticks), preferably light in color so that "seed ticks" show up like a patch of pepper.
2. **Boots or sturdy closed-toed shoes**. We will visit wet places with catbrier vines, snakes, chiggers, burning embers, smoldering duff, and ticks. Rubber boots are fine, except for controlled burns. NO SANDALS.

3. **Fire apparel**. No synthetic fabrics, which are made from petroleum, ignite readily, and burn hot.
4. **Water** or dilute Gatorade (and something to carry it in so your hands are free).
5. **Field notebook and pencil** - bound, water proof with half the pages graph paper. Be sure to date every page and note your location. The first pages of the notebook should contain space for a table-of-contents and be labeled with your name and contact information.
6. **Random number table**: extract and write at least 100 on the inside cover of your field book.
7. **Raingear** - a folding umbrella works well.
8. Bug repellent – please apply in a well-ventilated place.
9. Food - blood sugar levels must be maintained for the duration.
10. Hand lens - 10X or 15X—reasonably good ones can be purchased for about $10.
11. Cellphone, with CanopyApp loaded.
12. Binoculars if you have them (some good things to see are far away).
13. Hat and sunscreen.
14. Ruler - also mark the outside of your field book with centimeters.

IMPORTANT *CAUTIONARY* NOTE: In addition to beautiful landscapes, fascinating ecosystems, and compelling environmental problems, Florida offers us ticks, chiggers, mosquitoes, and poisonous snakes. Furthermore, given that our controlled burns involve open flames and smoke, they involve some small risks as well. We will do all we can to assure your safety in the field but you need to dress appropriately, follow instructions, and otherwise being careful so as to minimize risks and unpleasantries.

LECTURE SCHEDULE

DATE	TOPIC	
1/7	Course introduction and paleoecology	
1/9	Paleoecology workshop on time-reading methods	
1/14	Climatology workshop	
1/16	Global climate change and sea level rise	
1/21	Coastal ecology (in preparation for the Friday/Saturday field trip, 24 or 25 February)	
1/23	Fire ecology (in preparation for the first fire, 3-5 February)	
1/28	More Fire ecology	
1/30	Carbon relations (photosynthesis and respiration)	
2/4	More carbon	
2/6	**Exam 1**	
2/11	Plant water relations	
2/13	More water	
2/18	Soil genesis and ecology	
2/20	Nutrient cycling	
2/25	Disrupted biogeochemical cycles	G
2/27	Nitrogen and carbon cycles	G
3/3-5	NO CLASS SPRING BREAK	
3/10	Lawn ecology, pollution, evil empires, and culture	
3/12	Justification for my anger at Professor Jack (and his generation)	
3/17	**Exam 2**	
3/19	Plant life histories and tradeoffs	
3/24	Community ecology	
3/26	Competition and tradeoffs	
3/31	Herbivory and tradeoffs	
4/2	Population ecology	
4/7	Disturbance, succession, and community dynamics	
4/9	Invasive exotics and novel ecosystems	

4/14 More on exotic invasive species
4/16 Restoration ecology
4/21 Global ecology and conservation
Final exam TBD

LAB SCHEDULE

Lab	Date	Title (assignment due dates *italicized*)	Meeting place*
1	1/6-8	Paleoecology	FLMNH
	1/16	*Self-portrait with plant due (CANVAS submission)*	
	1/17	*Plant data in EXCEL due*	
	1/17	*Drawn and scanned Figures 1 & 2 from Lab 2 due*	
	1/18	*Paleoecology assignment due*	
2	1/13-15	Plant ecology samplings	BAR or NATL
3	**1/24/25 (F/S)**	**Coastal ecology (departure at 9:30 AM)**	**BARTRAM**
4	1/27-29	Data graphing and analysis with EXCEL	114 Rolfs
5/6	2/3-5	Fire 1 or Paynes Praire	BARTRAM
	2/7	*Coastal change model due*	
5/6	2/10-12	Fire 1 or Paynes Praire	BARTRAM
	2/14	*Fire proposals due*	
5/7	2/17-19	Sandhills, flatwoods, and cypress domes or Fire 2	Morningside
5/7	2/24-26	Fire 2 or Sandhills	BAR/CARR
	3/2-4	**Spring Break, no labs**	
8	3/9-11	Oral presentations of fire research	114 Rolfs
	3/13	*Fire manuscripts due (first submission)*	
9	3/16-18	Phylogeny, functional morphology, and plant keying	114 Rolfs
10	**3/27/28 (F/S)**	**Edge effects in Ocala National Forest (9:30 AM)**	**BARTRAM**
11	3/30-4/1	Forest dynamics and matrix models	McCarty Woods
12	4/6-8	Edge poster presentations	114 Rolfs
	4/13-15	Lab Practical, *plant collections due*	114 Rolfs
	4/17	*Fire manuscripts due (final submission)*	
	4/20-22	No regular labs	

Vans depart promptly at 12:50 PM from the parking lot behind Bartram Hall for Monday-Wednesday labs and at 9:30 AM for Friday/Saturday labs. Note that for the first lab (first week of classes) you will need to find your own way to the Florida Museum of Natural History (FLMNH), which is easily accessed by bicycle or campus bus. For field trips for which transportation is provided, do not arrive late lest you will watch the van fade into the distance (12:50 for regular lab trips and 9:30 AM for those on Fridays/Saturdays). For the lab in McCarty Woods, meet the class at the picnic tables just across the street from Dickinson Hall on Museum Drive. For the two Friday or Saturday labs, we will depart from behind Bartram Hall at 9:30 AM.

LAB 1: **GEOLOGICAL AND BIOLOGICAL HISTORY OF FLORIDA**

Site: Florida Museum of Natural History (FLMNH)—*get there on your own (easy by bicycle or bus (#20 or #33) to the Harn Museum or SW Recreation Center.)*
Due: 18 January, submitted on-line (CANVAS)
Goals:

1. Learn more about the Paleoecology of Planet Earth and the much shorter history of Florida.
2. Develop a paleoecological perspective on Florida's ecosystems.
3. Learn how humans interacted, adapted, and modified Florida ecosystems.

Giving the comings and goings of UF students during the first week of classes, this lab is designed to be self-directed for those who did not attend any of the scheduled labs during the first week of classes (note that Monday lab people are welcome to join the Tuesday or Wednesday sessions if they missed their regularly scheduled lab---or visit the FLMNH and complete the assignment on your own).

PART 1: FLMNH Hall of Fossils
Spend a couple of hours in this award-winning exhibit. Be sure to listen to the recordings at each of the stations in the corners of the room.

PART 2: TIME LINE
Assignment Specifics: Answer the questions and create the timeline, as instructed below. This assignment is to be submitted on the CANVAS site (scan your timeline for on-line submission and/or submit it on paper). Many of the specified events to be included are displayed in the Hall of Fossils at FLMNH, but some you will have to find elsewhere (e.g., on the web). Some helpful online videos, which you are expected to watch, will provide further information you need for this assignment in particular and to develop a sense of time in general.

Time	**Before Present Acronym**	**Years Ago Acronym**	**SI Unit (annum = year)**
1,000	kYBP	kya	ka (kilo annum)
1,000,000	MYBP	mya	Ma (Mega annum)
1,000,000,000	BYBP	bya	Ga (Giga annum)

If you do not have an answer with which you are confident, write a sentence describing the answers you considered.

1. Why was a band of iron deposited around the world about 2.45 BYBP
2. When did what is now the intersection of University Avenue and SE 13th Street in Gainesville **first** emerge above the sea?
3. How do geologists recognize the end of the Paleozoic Era (252 MYBP)?
4. Why don't you expect to find any *Tyrannosaurus rex* fossils in Florida?

5. When did the "Age of Mammals" begin?
6. Why don't sharks need dentists?
7. If you encountered a large proboscidean while strolling through a forest north of Gainesville 25,000 years ago would it more likely be a Mammut americanum (American mastodon) or a Mammuthus columbi (Columbian mammoth)?
8. Why was *Eremotherium eomigrans* likely not a threat to early humans?
9. From what continents did ancestors of *Gomphotheres* and *Glyptodons* originate?
10. At the latitude of Gainesville (29^{o} N), how wide was Florida in the late Pleistocene relative to the present?
11. What is the biological origin of limestone rocks that underlie Florida?
12. Are the horses in the wild herd on Paynes Prairie direct descendants of the fossil horses (*Parahippis*) that occurred nearby during the Miocene some 18 MYBP? If not, what were the evolutionary and geographical sources of these horses?
13. Since when have sea levels been rising around Florida?
14. Why is the Florida peninsula higher in elevation towards its center than on its margins?
15. Were Florida's Paleoindians threatened by Titanis walleri (terror birds)?

TIMELINE CONSTRUCTION FOR THE HISTORY OF FLORIDA

After digging out the approximate dates for each of the following events (by all means, divide up the task and help each other), the challenge is to order them on your own timeline in a fashion that is useful to you. For events that occurred more than 500 years ago, note them as thousands, millions, or billions of years before the present (TYBP, MYBP, and BYBP respectively). Given that the events occurred over several orders of magnitude of time, your timeline might include breaks (e.g., a // sign) to foster accommodation. Those events for which the matching date can be found in the Florida Museum of Natural History are noted with an asterisk. After struggling with the powers-of-ten problem, you might consult the web for functional and artistic solutions to this problem (e.g., Google on "geological time line"). For example, your timeline might include breaks (e.g., a // sign) to foster accommodation of the vast spans of time. Your timeline will be judged according to its completeness as well as the insights it captures and inspiration it displays, not its execution (i.e., do not spend too much time on making a neat presentation). Also, some of what you are expected to do is hard but hopefully provocative—take your best shot at answering the questions but avoid getting "stuck" for too long, which is not productive. As always, feel free to ask one of your instructors via e-mail or etc.

YOUR TIME LINE SHOULD BE LABELED WITH EACH OF THE FOLLOWING

1. Maize/bean/squash agriculture starts in Florida
2. *Extinction of the giant ground sloth
3. Spanish-American War in Cuba
4. Disneyworld opens
5. *The beginnings of the Paleozoic, Mesozoic, and Cenozoic Eras
6. *Newnans Lake permanent (1^{o} canoes)
7. A recent El Niño drought associated with mega-fires in Florida
8. Sea levels rising at 10 mm/year
9. Sea levels rising about 3 mm/year
10. Paynes Prairie a lake traversed by steamboats
11. Battle of Olustee

12, Asian people first arrive in Florida
13. *Florida platform connected to Laurasia and separates from Africa
14, Bartram begins his Florida travels
15. Ponce de Leon arrives in Florida
16, Henry Flagler finishes railroad to Miami
17. *Tapirs & armadillos first appear in the Northern Hemisphere
18. Hernando de Soto starts his march of death and destruction
19. *Florida peninsula the widest
20. Hurricane Donna trashes Miami and the Everglades
21. Florida taken from the Spanish for the last (?) time
22. Second Seminole Indian War ends
23. Last of the Calusas and Timucuans die
24. Hurricane Andrew trounces Miami
25. 1^{o} Everglades conservation (Royal Palm)
26. *Land bridge to South American forms
27. *1^{o} terrestrial fossils in Florida
28. *Life begins on Earth
29. *Florida simultaneously hosts spectacled bears, llamas, mammoths, mastodons, tapirs, and domestic dogs
30. *Extinction of glyptodonts
31. The "Big Bang" that resulted in the creation of the Universe
32. *Extinction of the terror bird
33. Free oxygen becomes abundant in the atmosphere
34. Creek Indians drift into Florida and become the Seminoles

ADD 6 MORE NOTABLE HISTORICAL/GEOLOGICAL EVENTS

ADDITIONAL RESOURCES

https://www.youtube.com/watch?v=5jyGpGJZO4A