

The Earth From Home:

A Homeschool Environmental Science Curriculum

AY 2019–20

developed by David J. Walbert

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Note to readers, 2025

I developed this curriculum in 2019 for homeschool environmental science, based on the rich resources and ecosystems of North Carolina, where I live. Unlike most current environmental It was a *very* successful year; I learned almost as much as my daughter did, and once in college she decided to minor in environmental studies. I share the curriculum here not to be used as-is but as a suggestion of how homeschool science—really, how science in any context—might be taught.

If you want to adapt this curriculum, please note:

- We are blessed in North Carolina with tremendous ecological and geological variety and were therefore uniquely positioned to incorporate field study into a broad curriculum.
- It draws heavily on my own interests and knowledge, which may not be yours. (In particular, I incorporated more advanced math than you might—though if possible I recommend exploring it *particularly* for a student who may not particularly enjoy math.) The activities take a wide range of forms, but might be more directly tailored to individual students.
- While I tried to write the schedule up thoroughly and professionally as we proceeded through the year, it was written for my own use at a particular time. (The schedule grows less detailed in late spring—after COVID hit and we had to adapt, and when I allowed more time for working on the capstone research paper.)

I hope you find this to be of some use.

—[David Walbert](#), January 2025

Overview

This curriculum addresses the standards for AP Environmental Science (*note: I used the 2013 version*), but assigns those standards different weights than the AP curriculum (and is thus not necessarily designed to prepare the student for the AP test in that subject). While the AP standards provide a good list of topics to be covered in an advanced high school course, they assign too little weight to how the natural world *works*, and *ought to work*, and too much to what is *wrong* with it; it is as much (or more) a course in environmental policy as a course in environmental science. Specifically, in the AP course, 25–30% of time is to be spent studying pollution and another 10–15% on “global change,” meaning that fully half the course could address ways humans have screwed things up and what we ought to be doing about it. While these matters are important, we believe that to frame a high school course in terms of public policy is to put the cart before the horse. Specifically,

1. It is irresponsible to attempt to change the world until one understands it as it is.
2. Before one tries to understand the world, one ought to love it.

The most advanced course in science (any science, but environmental science especially) ought therefore to draw on the wonder of childhood nature study to animate its exploration of received scientific understanding and further development of tools for scientific inquiry, then (and only then) address the implications of this understanding for individual human activity and public policy.

To that end, this course

- combines a broad range of scientific sources with “nature writing” that contextualizes the science;
- focuses on local examples, using field study within North Carolina;
- requires laboratory work, quantitative analysis, and written qualitative response as appropriate;
- uses policy analysis as a capstone to integrate learning rather than as a framing device.

Resources

Textbooks

These textbooks are available online under open licenses.

- Steven Earle, [Physical Geology](#)
- Matthew R. Fisher, ed. [Environmental Biology](#)
- Caralyn Zehnder et al, [Introduction to Environmental Science, 2d ed.](#)
- Bradley Deline et al, [Laboratory Manual for Introductory Geology](#)
- Roland Stull, [Practical Meteorology: An Algebra-Based Survey of Atmospheric Science](#) (maybe)
- John M. Anderies and Marco A. Janssen, [Sustaining the Commons](#), 2d ed.

Additional reference books we will use throughout the year:

- Dirk Frankenburg, ed., [Exploring North Carolina's Natural Areas: Parks, Nature Preserves, And Hiking Trails](#)

Additional books

This list will doubtless change as we work through the year, but have these on hand to start. Note that this is not to be confused with a reading list! We will excerpt most and use some as reference for specific lessons or units.

- Edward Abbey, [Desert Solitaire](#)
- R. A. Bagnold, [The Physics of Blown Sand and Sand Dunes](#)
- Wendell Berry, [A Continuous Harmony](#)
- Elizabeth Colbert, [Field Notes from a Catastrophe](#)
- Annie Dillard, [Pilgrim at Tinker Creek](#)
- Richard Ellis, [The Empty Ocean](#)
- Dirk Frankenburg, [The Nature of North Carolina's Southern Coast](#)
- William T. Fox, [At the Sea's Edge](#)
- James Gleick, [Chaos: Making a New Science](#)
- Michael A. Godfrey, [Field Guide to the Piedmont](#)
- John McPhee, [The Control of Nature](#)
- Michael Pollan, [The Omnivore's Dilemma](#)
- Janisse Ray, [Ecology of a Cracker Childhood](#)
- William Stolzenburg, [Where the Wild Things Were](#)

Web Resources

- [Carolina Environmental Diversity Explorations](#) (via Wayback Machine)

Field trips

- Mountains I: Monadnocks
 - [Pilot Mountain State Park](#) (monadnocks — September)
- Wetlands
 - [Pocosin Lakes National Wildlife Refuge](#) (October)
 - Migratory waterfowl are there in winter, so we could also save this for later.
- Barrier islands, seashore, estuary and black river ecology (November)
 - [Hammocks Beach State Park](#), 2:30 from Raleigh, with maritime forest, Bear Island, and the end of the White Oak River. There is ferry service from the mainland, or you can rent a canoe.
 - However, Hurricane Florence did a great deal of damage and many facilities are closed. Ferry is expected to resume in July 2019 but see [current info page](#).
 - Then on the way back visit [Croatoan National Forest](#), also coastal forest, borders the river, to see the river ecosystem further upstream. This lets us discuss barrier island geology, but also estuaries, black rivers, and ecology of decreasing salinity as we move upstream. If possible, see the river at 2 or more places in the forest.
 - The White Oak ends in a Pocosin, which we will already have visited.
 - Backup plan: [Carolina Beach State Park](#) for barrier island geology/ecology in November, then make a separate trip to Croatoan National Forest in the early spring. This may be better even if we are able to go to Hammocks Beach.
- Longleaf pine forest (January/February)
 - [Weymouth Woods Sandhills Nature Preserve](#)
 - Has old-growth longleaf pine savanna.
 - Visit Town Creek Indian Mound on the way back.
- Coastal ecology II/Sand dunes
 - Jockey's Ridge State Park
 - August 2019 to combine with visit to see *The Lost Colony*
 - Prep by reading about the physics of sand dunes
- Piedmont forest & river ecology (April)
 - Eno River, likely. (Also use to compare brown water river vs. blackwater river.)
- Mountains II: Appalachians (June)
 - [Gorges State Park](#) (Jocassee Gorges)
 - [Roan Mountain National Forest](#) (open Memorial Day weekend through September; rhododendrons bloom mid-June)

Supplies

- I believe we can use lab supplies we already have from biology and chemistry courses. As I plan specific labs (and as we execute them) I'll write out specific equipment used, for reference.
- Large tracing paper, to layer for physiographic map(s) of North Carolina.

PART I. EARTH SYSTEMS

Unit 1. The earth & the lithosphere

Week 1: Introduction: Natural and local diversity (Aug 26–Sep 1)

Readings:

- Wendell Berry, “It All Turns on Affection” (NEH 2012 Jefferson Lecture)
 - [Video of lecture](#)
- [Natural Diversity of NC](#) (Walbert) (provinces, NC physiography)
- Physiography of the United States: *Lab Manual for Intro. Geology* 14.2
- Godfrey, *Field Guide to the Piedmont*, ch. 1

Additional Resources:

- [Physiography of North Carolina](#)

Activities:

- **Response to the Berry lecture:** As you watch and/or read the lecture, take notes. Write a brief (100–200 words) summary of his argument, trying to be accurate and thorough but concise. If there are parts of his argument that you didn’t understand, note them, and say what additional context you might need in order to understand them. For now, don’t evaluate his argument (say whether you agree or disagree); we will return to it later in the year.
- **Discussion:** In discussion, evaluate Berry’s argument. If we agree, think about why we may be inclined to do so. If we disagree with any or all of it, consider what we might have to believe to be true in order to agree with it.
- **North Carolina geography:** Draw an overlay (using tracing paper) for your [18x24” North Carolina map](#) showing the geologic provinces, being as precise and detailed as you can. Research as necessary, and answer the following questions:
 - Define *physiography*.
 - What characteristics define and differentiate the major geologic provinces of North Carolina?
 - Are these provinces unique to North Carolina? What is their range?
 - For each, find an example of another geologic province in North America that resembles it, and explain how and why.

Notes:

The Berry lecture is intended to frame the year’s study by a discussion of care and relationships. Much of what falls under the heading of “environmental science” is scattershot and reductive, and much of the rest is large-scale policy prescriptions. These are necessary but limited approaches, and taken

together and in isolation from other concerns leave students with the impression that the earth is a problem to be solved—rather than, as it should be, a wondrous creation to be cared for. Since care is hard to conceive on a global scale, the goal of this curriculum is to build understanding not only of general systems but of specific places, along with respect for their complexity and, I hope, affection.

The remainder of the reading introduces the physiography and (quite impressive) natural diversity of a single state, which is the place where we will make our explorations during the year. The student should come away not only with some specific (if still broad) information about the state's geology and ecosystems but (more importantly at this stage) with a sense of the variety and complexity that exists in what is after all a very small piece of the world.

Week 2: Geologic time and processes (Sep 2–8)

Readings:

- Origin of the earth and solar system: Earle, *Physical Geology*, 22
- Plate tectonics: Earle, *Physical Geology*, 1.5
- Geologic time: Earle, *Physical Geology*, 1.6
- [Geological time](#) (USGS)
- [Natural History of North Carolina](#) (Walbert)
- [Geologic History](#) [of NC] (NCPedia)

Additional Resources:

Skim and/or use for research for activities.

- Glaciation: Earle, *Physical Geology*, 16
- Geologic time: Earle, *Physical Geology*, 8
- The earth's interior & magnetic field: Earle, *Physical Geology*, 9.1–3

Activities:

- **North Carolina geography:** To your geologic map of North Carolina (first overlay), add key geologic features and when and how they were formed. Include the Blue Ridge, the Sauratown Mountains, Uwharrie Mountains, Sandhills, fall line, barrier islands, and at least one other feature of your choice. Research as necessary, take notes on what you learn, and be prepared to explain and defend your map.
- **Oral presentation:** Give a brief (5 minute) oral presentation on plate tectonics, explaining how scientists believe it works, *why* they believe it to be so, and the impact this process has had on the earth's geologic history. Be prepared to take questions, and use visuals if desired.

Week 3: Rocks, minerals, and the rock cycle (Sep 9–15)

Readings:

- Minerals and Rocks, formation, properties: Earle, *Physical Geology*, 1.4, 2.5, 2.6
- Rock cycle: Earle, *Physical Geology* 3.1
- Marshall Ellis, “Lonely Mountains: The Sauratowns from Hanging Rock to Pilot Mountain State Parks,” *Exploring North Carolina’s Natural Areas* 221–232 (prep for field trip)

Additional Resources:

- [Physiographic Map of North Carolina](#) (with rock types, 1906)
- [Lonely Mountains: The Monadnocks of the Inner Piedmont](#) (CEDE)

Activities:

- **Response to reading:** Write a brief explanation of the rock cycle in your own words.
- **Map work:** Find, if possible, two examples of where each type of rock can be found on your NC map. Present, explaining how and when each of the rock types was formed. If no examples of a given type exist in NC, explain why.
- **Lab:** Examine rock samples. Discuss geographic and geological origins, chemical compositions and crystalline structures, and means of identification as possible/desired.
 - We examined a set for educators from the North Carolina Aggregates Association and four sets from American Educational Resources (one each for igneous, metamorphic, sedimentary, and minerals). For the NC set we looked up each rock on a map to see what part of the state geologically it was from. We looked up chemical compositions for minerals mentioned and talked briefly about how their chemical composition affects coloring, reactivity, and structure. We also tested magnetite with a bar magnet, and dissolved limestone and marble with leftover 1M hydrochloric acid from chemistry class.
- **Field trip prep:** Prepare for the field trip by finding driving directions and travel times and making notes of points of particular interest so that you can help guide your driver. Be prepared to explain to your teacher/driver what you know about these sites, and as you visit, to jot down questions for further research. What references should you take along with you to facilitate on-site research? What other tools would be helpful (e.g. binoculars, camera, sketchbook, etc.)?

Field trip:

- Field trip to [Pilot Mountain State Park](#). (If time permits, visit [Hanging Rock State Park](#) while in the area.)

[SEP. 18–22 TRIP TO PENNSYLVANIA]

Week 4: Earthquakes and Volcanoes (Sep 23–29)

Readings:

- Volcanoes: Earle, *Physical Geology*, 4
- Earthquakes: Earle, *Physical Geology*, 11
- Tsunamis (case study)
 - Allison Mills, "[December 26, 2004: Indian Ocean Tsunami Strikes](#)" (Earth Magazine)
 - "[Ten Years Since the 2004 Indian Ocean Tsunami](#)" (The Atlantic)

Additional Resources:

- [Induced Earthquakes](#) (USGS)

Activities:

- Response to reading: Write a brief explanation of how a tsunami occurs. How did the Indian Ocean tsunami specifically happen? What did you find most surprising or interesting about what you read?
- Fracking (extraction of natural gas via "hydraulic fracturing" of rock) has been named as a cause of earthquakes. Research this topic and present:
 - What is fracking?
 - How is it thought to have caused earthquakes? What evidence is there for this causality?
 - What are the objections to these arguments? What else may have caused these earthquakes?
 - Evaluate the various *scientific* arguments for and against. Is there a scientific consensus, or is the issue yet undecided? Given what you have read, do you think the issue is serious enough to merit public action?

Week 5: Soil and soil dynamics (Sep 30–Oct 6)

Readings:

- Earle, *Physical Geology*, 5.1–4
- [Soil Basics](#) (Soil Science Society of America). Be sure to read the pages linked in the sidebar!
- "[When Does Rock Become Soil?](#)" (linked from above)
- "[Cecil: North Carolina State Soil](#)" (Soil Science Society of America)
- Dirk Frankenburg, [Clays of the Piedmont: Origins, Recovery, and Use](#) (Carolina Environmental Diversity Explorations, LEARN NC, via Wayback Machine)

Additional Resources:

- [Soils Overview](#) (Soil Science Society of America)

- [General Soil Map of North Carolina](#) (U.S. Soil Conservation Service, via [Library of Congress](#))

Activities:

- Response to reading:
 - What is soil? How does it form?
 - How are different types of soil defined or distinguished? Is there a single taxonomy (list of types & definitions) of soils, or are there different ones? If they differ, why do you think they do?
- Draw a new overlay for your NC map showing types of soils in North Carolina. (Use your own judgment about how specific you can or should be in differentiating soil types.)
 - How do soil types relate to underlying geology?
 - Choose three types of soil in North Carolina and discuss their uses in agriculture and/or industry. (Two of these have been given to you in the reading. You will need to research the third; you may want to start by researching the agriculture of that part of the state and then find out how the specific crops grown there take advantage of the soil type present.)

Week 6: Streams and floods: The hydrological cycle (Oct 7–13)

Readings:

- Earle, *Physical Geology*, 13 (skip or skim the portions of 13.5 related only to Canada)
- Case Study: [Hurricane Floyd](#) (NCPedia, or use original via [Wayback Machine](#)). Read all articles in the series and listen to the oral histories.

Additional Resources:

River basins:

- [NC River Basins map](#)

Floodplains:

- [Benefits of Healthy Floodplains](#) (Nature Conservancy)
- [“It’s Time to Ditch the Concept of ‘100-Year Floods’”](#) (Five Thirty-Eight)
- [FEMA Flood Map Service Center](#)

Hurricane Matthew:

- [Hurricane Matthew in the Carolinas](#) (National Weather Service)
- [Hurricane Matthew Resilient Redevelopment Plan](#)
- [Characterization of Peak Streamflows and Flood Inundation at Selected Areas in North Carolina Following Hurricane Matthew, October 2016](#) (USGS)

Activities:

- **North Carolina geography:** Draw a new overlay for your NC map showing major rivers and river

- basins.
- Research floodplains.
 - How are floodplains defined? How are these designations determined?
 - Find a floodplain map for your city or county. Do you live in a floodplain? If so, what kind? If not, where is the nearest floodplain? When was the last time it flooded?
 - Research the effects of Hurricane Matthew (2016) on eastern North Carolina.
 - Where was flooding worst? Why was flooding so bad in these areas?

Week 7: Groundwater (Oct 14–20)

Readings:

- Earle, *Physical Geology*, 14
- [Wetlands of the Coastal Plains](#) (CEDE, via Internet Archive)
- B. J. Copeland and Lundie Spence, “Albemarle-Pamlico Peninsula: Pocosin Lakes and Wetlands,” *Exploring NC’s Natural Areas*, 117–124 (prep for field trip)
- [Pocosin Lakes Hydrology Restoration](#) (prep for field trip)

Activities:

- Prepare for the field trip by finding driving directions and travel times and making notes of points of particular interest so that you can help guide your driver. Be prepared to explain to your teacher/driver what you know about these sites, and as you visit, to jot down questions for further research. What references should you take along with you to facilitate on-site research? What other tools would be helpful (e.g. binoculars, camera, sketchbook, etc.)?
- Research wetlands and their loss. Make a chart of types of wetlands that occur in North Carolina with brief descriptions, including how they are formed, where they occur, and what kinds of life they support. (I found 16 types.) See if you can find estimates of how much land in North Carolina (or similar region) was once wetland and how much wetland remains. What are the consequences (environmental and to humans) of this loss? Write a brief (100–200 word) summary of your findings.

Field trip:

- [Pettigrew State Park](#) and (if time permits) [Pocosin Lakes National Wildlife Refuge](#)
 - This is in Columbia, NC, about 2½ hours away. Long day trip; plan for Thu. Oct. 17.

Week 8–9: Oceans and Shorelines (Oct 21–Nov 3)

Because we have more reading and activity about shorelines than about oceans, I’ve combined these topics into one two-week unit, culminating in our field trip to Carolina Beach State Park.

Long-term assignment: Shifting Shorelines Position Paper

This week we'll begin working on a "position paper" (an essay written for scientifically based advocacy) that will be due before Christmas. Here's the assignment:

- Write a brief (2000-word) position paper arguing for or against maintaining existing shorelines on North Carolina's coast.
 - a. Begin by discussing the forces (natural and human-made) impacting shorelines, both shifting them and keeping them constant, and the extent to which shorelines have changed or remained constant over time. Which (types of) shorelines in North Carolina are more or less stable, and why?
 - b. Next, consider two examples of attempts to maintain existing shorelines in the face of these forces. What were the costs? Who paid them? How successful was each project?
 - c. Lastly, state whether you are for or against working to preserve existing shorelines, and explain why. (You may also be for it in some cases and against it in others!) If for, explain why you believe the benefits outweigh the costs, propose a specific method for a specific type of shoreline, explain why it is preferable to others, and propose a method of paying for the work that you believe to be fair. If against, explain why various methods are impractical or too costly, and how the impact of shifting shorelines can be ameliorated or spread fairly.

This sounds like a lot of work (and it is!), but between now and Christmas, each week's readings will be part of your research, and the activities will have you start outlining and drafting various portions of the paper, so it won't all have to be done at once.

Readings:

Oceans:

- [Physical Geography](#), Oceans and Coastal Environments

Shorelines:

- Dirk Frankenburg, *The Nature of North Carolina's Southern Coast*, 1–44
- [Hurricanes on Sandy Shorelines: Lessons for Development](#) (CEDE, via Wayback Machine)

Additional Resources:

- Fox, *At the Sea's Edge*, 6 (Barrier Islands and Spits).

Activities:

Oceans:

- How did trade winds shape early European exploration and, well, (duh) trade? Write one good paragraph in response, explaining what the trade winds are and giving at least two specific examples. Research as necessary. (Hint: NOAA, the National Oceanic and Atmospheric Administration, has good information on the oceans, as you might expect from its name. Try

searching usa.gov first.)

- How do deep ocean currents impact global climate (which, admittedly, we haven't learned about yet)? Write one good paragraph in response, providing at least one specific example of a part of the world whose climate is shaped by ocean currents.

Shorelines:

- As you read, take good notes with part 1 of your position paper in mind. When you are finished, outline part 1, and decide what other questions you will need to answer. Discuss those questions with your teacher, then decide together what additional research you should do and what sources may be most useful. Take the time remaining to work on that additional research.

Field trip prep:

- As usual, prepare for the field trip by finding driving directions and travel times and making notes of points of particular interest so that you can help guide your driver. Be prepared to explain to your teacher/driver what you know about these sites, and as you visit, to jot down questions for further research. What references should you take along with you to facilitate on-site research? What other tools would be helpful (e.g. binoculars, camera, sketchbook, etc.)?
- Additionally, read the [ecology](#) and [history](#) pages of the [Carolina Beach State Park](#) website and write down a list of questions for your position paper that you would like to try to answer on your trip.

Field trip:

- [Carolina Beach State Park](#)
 - Take a notebook, and write down anything you learn that could be useful in your position paper (with citations if appropriate).
 - Take photographs of anything you think may illustrate your position paper.
- ([Hammocks Beach State Park](#) was an alternate choice, but the Bear Island Ferry is closed for the season, so there would be little to see this time of year.)

Week 10: The Atmosphere (Nov 4–10)

Readings:

- [Physical Geography](#), The Atmosphere
- James Gleick, *Chaos*, chapters 1–2
- Silngo and Palmer, "[Uncertainty in Weather and Climate Prediction](#)" (time permitting)

Activities:

- Make a list or chart showing the layers of the earth's atmosphere, providing brief descriptions.
- Use the mathematical simulator to explore sensitive dependence on initial conditions. Be sure to

tell your teacher how cool it is, because he worked hard to build it. (We will do more simulations when we study population dynamics next semester.)

- [Sensitive Dependence on Initial Conditions](#)
- Suppose someone said to you, “How can I trust what those dumb scientists say about climate change when they can’t even tell if it’s going to rain next week?” Use what you’ve learned this week to write a response explaining how the nature of the atmosphere makes it possible to discuss broad trends and shapes while making it impossible to make highly local predictions. You’ll need to be clear and concise, and explain any highfalutin’ language you use! What examples, stories, etc. from your reading and activities might help convince your rhetorical interlocutor? (*Interlocutor*, n., person who poses a question of another person, in this case a *rhetorical question*, a question posed not to be answered but to make a rhetorical point, or a question that suggests its own answer.)
- As necessary or desired (and as time permits), add to your position paper draft from what you learned on your field trip to Carolina Beach State Park.

Week 11: Weather (Nov 11–17)

Because this is a busy week I have condensed the week’s activities.

Readings:

- [Physical Geography](#), Weather Processes and Systems

Additional Resources:

- William T. Fox, *At the Sea’s Edge*, ch. 2 (pp. 29–64)
- *Field Guide to the Piedmont*, ch. 2

Activities:

- Answer the following in response to your reading:
 1. What is the difference between weather and climate?
 2. What are air masses? What are the types of air masses affecting North America’s weather?
 3. What are the four types of fronts? Why do they form and what is their impact on local weather?
- Why does North Carolina see so many hurricanes? Research the formation of Atlantic hurricanes and their paths through the ocean, including the Bermuda High and any other pertinent geography. Write a response of sufficient length to answer the question adequately, then condense your response into a paragraph relevant to the topic of your position paper (and add it to your paper).
- If anything else from your reading seems relevant to your paper, add that as well or make notes for later.
- With any additional time this week, work on organizing and clarifying part 1 of your position paper.

Week 12: Climate (Nov 18–24)

Readings:

- [Physical Geography](#), Climate Systems and Change
- Read through NASA's website on climate change:
 - Read [Evidence](#), [Causes](#), and [Effects](#).
 - Skim [Scientific Consensus](#) and [Vital Signs](#).
 - Read "How global temperatures are studied" on the [FAQ page](#).

Additional Resources:

- [Climate Change — Pros and Cons](#)
- [Skeptical Science: Climate Myths](#)
- [How to Talk to a Climate Skeptic](#) (Grist)

Activities:

- Read *Laboratory Manual for Introductory Geology* 6.4–6.6 and do the lab exercise in 6.4 on analyzing sea ice change. The data for the lab in 6.6 is not available, but you can see the [visualization from NOAA](#). Answer questions 12 and 13 on p. 136 to the best of your ability.
- After reading the NASA articles, explain three things you learned that are particularly interesting to you and how they help you have a better understanding of climate science.
- Skim through the additional resources (read the "pros and cons" page more thoroughly). Choose three arguments that climate skeptics commonly make and explain how you would respond. Be sure to explain (as best you can) *how* scientists know what they say they know, and why the data and analysis are valid. (If you have trouble choosing three arguments, discuss with your teacher.)

[NOV 25–DEC 2 THANKSGIVING BREAK]

Week 13: Introduction to policy considerations (Dec 2–8)

Readings:

- *Sustaining the Commons*, ch. 1, 4
- Wendell Berry, "[Think Little](#)," in *A Continuous Harmony: Essays Cultural and Agricultural*
- John McPhee, *The Control of Nature*, ch. 1

Activities:

All written response and discussion this week, I'm afraid. It's that kind of topic.

- Response to *Sustaining the Commons*:
 - a. Explain what is meant by the "tragedy of the commons." (Be sure to explain what "the commons" is!) Why do the authors argue that the tragedy is not inevitable?

- b. In chapter 4, the authors discuss four types of resources based on their allocation: private goods, club goods, common-pool resources, and public goods. Think of an example of each type of good relating to your study of shorelines and explain why you believe it fits the definition of that good.
 - c. **For discussion:** Using the economic concepts covered in chapter 1, provide an explanation of why the residents of Byrd Street keep dumping their leaves in the street. How might the prisoner's dilemma and/or the coordination game provide models for understanding and/or fixing the leaf problem on Byrd Street?
 - d. **Bonus question.** Do you think your teacher should quit harping on the dang leaves? Why or why not?
- Response to Berry essay:
 - a. Summarize Berry's critique of the environmental movement (and of "movements" in general). Do you think this criticism is valid?
 - b. **For discussion:** How does Berry's admonition to "think little" relate to the concepts you read about in *Sustaining the Commons*?
 - In McPhee's account of attempts to control the Mississippi River, what parallels might there be with shoreline control in North Carolina?

Weeks 14–15: Case study: The Barrier Islands (Dec 9–22)

During these two weeks you will complete the research for and write your position paper on shifting shorelines. (This is a lot of work, but it beats a midterm exam!) Here's the assignment again (*N.B.* I have clarified part b somewhat):

- Write a brief (2000-word) position paper arguing for or against maintaining existing shorelines on North Carolina's coast.
 - a. Begin by discussing the forces (natural and human-made) impacting shorelines, both shifting them and keeping them constant, and the extent to which shorelines have changed or remained constant over time. Which (types of) shorelines in North Carolina are more or less stable, and why?
 - b. Next, consider two examples of attempts to maintain existing shorelines in the face of these forces. Provide an argument for and against each method (you need not agree with them). What were the costs, and who paid them? What were the outcomes (natural and political)? How successful was each project?
 - c. Lastly, state whether you are for or against working to preserve existing shorelines, and explain why. (You may also be for it in some cases and against it in others!) If for, explain why you believe the benefits outweigh the costs, propose a specific method for a specific type of shoreline, explain why it is preferable to others, and propose a method of paying for the work that you believe to be fair. If against, explain why various methods are impractical or too costly, and how the impact of shifting shorelines can be ameliorated or spread fairly.

During week 14 (Dec 9–15), finish any work remaining for your draft of part 1. Then research and draft part b, and as time permits begin making notes for part c.

During week 15 (Dec 16–22), finish drafting part c and write an introduction for your paper. You will now have a complete draft (yay again!). Before break, we will go over your draft and begin revising it. If necessary, we'll finish revising during the first week of January.

[CHRISTMAS BREAK]

Unit 2. The biosphere

Week 17: Ecosystems (Jan 6–12)

Readings:

- *Environmental Biology* ch. 3
- Edward Abbey, *Desert Solitaire*, introduction, pp. 1–14, 22–38
- Annie Dillard, *Pilgrim at Tinker Creek*, ch. 1–3

Additional Resources:

- [Map of major North Carolina forest types, 1940](#) (UNC Libraries)
- More detailed list of [NC forest types by region](#)

Activities:

- **Research & presentation: Types of ecosystems.** We already looked at North Carolina's seashores and wetlands; now let's consider forest types. North Carolina has many types of forest, some existing only at particular elevations in the mountains. List the five most common or important forest types. How are they categorized? Describe each briefly. Where do they thrive (or where, historically, did they thrive), and why, based on climate, soil, geology, etc.? Present your findings.
- **Written response to nature writing (due next week):** Each writer went (more or less) alone into a particular ecosystem and spent that solitude walking, looking, thinking, and writing, but they came away with very different books.
 1. How would you describe the ways that Dillard and Abbey related to their natural environments? What are some similarities in the ways each experienced, interacted with, and described their neighborhoods? Give at least one concrete example from each

- book. What are some differences? Again, give at least one pair of concrete examples.
2. Do you think their different approaches had more to do with the personalities of the authors, or with the ecosystems themselves? Which account did you find more compelling?

Week 18: Natural change in ecosystems (Jan 13–19)

There are many ways and reasons ecosystems may change with time. Species movement due to climate change is one. Another is major disruptions—caused by natural disaster, disease, or human activity—which may be followed by gradual restoration or by adaptation to new conditions. This week we'll look at three examples of sudden and gradual change in North Carolina forests.

Readings:

- Climate change: D'Lyn Ford, "[Forests in Flux](#)," NC State University News Service
- [History of the American Chestnut Tree](#) (American Chestnut Foundation)
- Forest succession (restoration after agriculture):
 - *Field Guide to the Piedmont*, ch. 4
 - [Piedmont Forest Succession](#)

Activities:

- Finish compare/contrast essay from last week.
- **Response to reading:** Write a brief explanation of how a piece of clearcut land in your part of North Carolina might return to forest, and give rough estimates of how long the process would take. (In the spring, when we return to forestry, we'll do a related lab. We need the trees to be leafing out so we can identify them! Make sure your summary and notes are good enough that you will be able to refer to them then.)
- **Long term project:** Begin mapping out the big spring research paper by writing 10 key questions you will need to answer. Then determine next steps in the research process.

Week 19: Population Ecology (Jan 20–26)

Remember exponential growth and logistic functions? You know, that stuff in precalculus you *took a test on just this morning*? By the most wonderful coincidence, you get to apply it *today*! What's even more fun is that you get to learn about why those simple population models are a bit too simple for the real world... and explore some cases where even simple models can produce bizarre results.

Readings:

- *Environmental Biology* ch. 4.1–4.2
- *Introduction to Environmental Science*, ch. 2
- Gleick, *Chaos*, ch. 3

Activities:

- **Quick questions:**
 - What is population ecology?
 - List six characteristics of populations.
 - How do scientists estimate population size?
 - What is the difference between density-dependent and density-independent factors that limit population growth? Give two examples of each.
 - Explain the three types of survivorship curves.
- **Math application (yay!):** Do the population ecology practice problems (1–8), *Introduction to Environmental Science*, p. 12.
- **Lab:** Explore the [Nonlinear Population Modeler](#), answering the questions provided. Then explore the [Nonlinear Population Modeler #2](#), using some of the same data you entered in the first model. What differences do you observe? What did you learn from this activity about ecology—or about math?

Week 20: Community Ecology (Jan 27–Feb 2)

Readings:

- *Environmental Biology* ch. 4.4
- *Where the Wild Things Were* (excerpt TBA)

Activities:

- For your reference, define *in your own words* the following terms:
 - ecological niche
 - competitive exclusion principle
 - symbiosis
 - commensalism
 - mutualism
 - foundation species
 - keystone species
 - climax community
- **Discussion:** After reading *Where the Wild Things Were*, discuss the book's big idea(s). Are you convinced that "rewilding" is necessary? wise? possible? What would your local world look like if it were rewilded? How would (or could) humans fit into that world?

Week 21: Human demography (Feb 3–9)

Several short readings, plus a podcast and video (we'll listen/watch these together). Then a somewhat speculative discussion.

Readings:

- *Introduction to Environmental Science*, ch. 3
- Watch video/animation “[Human Population Through Time](#)” (American Museum of Natural History)
- [A Century of Population Change in the Age and Sex Composition of the Nation](#) (US Census Bureau)
- Amanda Ruggeri, “[Do We Really Live Longer than Our Ancestors?](#)” (BBC, 2 Oct 2018)
- Listen to Foreign Policy First Person podcast “[The Dark Legacy of China’s One Child Policy](#)” (interview with Nanfu Wang)
- Wendell Berry, excerpt from “The Body and the Earth” (originally in *The Unsettling of America*, here in *The Art of the Commonplace*), pp. 126–130

Additional Resources:

- Lily Kuo and Xueying Wang, “[Can China Recover from its Disastrous One-Child Policy?](#)” (*Guardian*, 2 Mar 2019)
- [Fertility Rate](#) (Our World in Data)
- [Life Expectancy](#) (Our World in Data)
- [Child & Infant Mortality](#) (Our World in Data)
- G. Nargund, “[Declining birth rate in Developed Countries: A radical policy re-think is required](#)”

Activities:

- **Discussion:** The environmental consequences of exponentially growing human population ought to be fairly obvious, as is the Malthusian concern that eventually we’ll run out of resources. But there are also consequences to limiting population growth, not all of them positive.
 - Why do birth rates decline in “developed” countries?
 - What does “life expectancy” really mean? Why is it longer now than it was, say, 200 years ago?
 - How might the aging of a population affect its economy, its social interactions, its culture, etc?
- **Capstone project:** Work on research project TBA.

Week 22: Biodiversity (Feb 10–16)

This unit leads directly into the next, our case study of the longleaf pine savanna. After you finish your reading and response, you can begin next week’s reading.

Readings:

- *Environmental Biology* ch. 5
- [Biodiversity loss in North Carolina](#) (News & Observer, 2016)
- Brooke Jarvis, “[The Insect Apocalypse is Here](#)” (*New York Times*, Nov. 27, 2018)

Extras:

- [The North Carolina Biodiversity Project](#)

Activities:

- **Response to reading:**
 - Explain three reasons why biodiversity is declining. Be specific! Don't just say, for example, "loss of habitat," but try to explain how the shrinking of habitat can diminish the number of species in a given habitat. Also note that you may bring in a reason not raised in today's reading, if you have read about it elsewhere!
 - Explain why biodiversity is important both for humans and for ecosystems as wholes. Do you feel that your textbook explained this in a manner sufficient to impel readers to action? Why or why not? If not, is there a way its importance could be communicated more effectively?
 -

Field trip:

Week 23: Case study: The longleaf pine savanna (Feb 17–23)

Readings:

- [Forests and Fires: The Longleaf Pine Savanna](#) (CEDE)
- Janisse Ray, *Ecology of a Cracker Childhood*

Activity:

- As you read *Ecology of a Cracker Childhood*, for each chapter, write down one (or more, if you choose) thing you found particularly interesting. We'll use these notes for discussion.
- Also be thinking, as you read, about what your own "personal ecology" would look like if you were to write it.
- **Discussion** about the book, based on your notes, will follow.

PART II. HUMAN ACTIVITY & IMPACTS

Unit 3. Land & water use

Week 24: Ecology of agriculture (Feb 24–Mar 1)

Readings:

- *Environmental Biology*, ch 9.1–9.4
- Michael Pollan, *The Omnivore’s Dilemma*, ch. 1
- Tim Folger, “[The Next Green Revolution](#),” *National Geographic*.

Activity:

- **Research the dangers of *monoculture* to food security.**
 - First, define monoculture. Why is monoculture the norm in modern agriculture?
 - Research the Irish potato famine. What were its causes? There were both biological/agricultural and social/economic causes; try to find both, but be sure to explain the former as carefully as you can. What was its impact? (Cite at least two sources.)
 - What is the relevance of the song “Yes, We Have No Bananas” to this discussion? (See suggested resources, below.)
 - What other crops may be threatened by similar devastation in the coming decades? Are there factors in global agriculture that make it more or less likely?

Suggested Resources:

- “[Monoculture and the Irish Potato Famine](#)” (*Understanding Evolution*, U. Cal-Berkeley)
- Steven Savage, “[Yes, We Have No Bananas, but Monoculture Wasn’t So Easy to Avoid](#)” (*Forbes*, 12 Jan. 2018)

Week 25: Agriculture and ecological community (Mar 2–8)

Here we consider both the ecological community of agriculture itself and how agriculture can coexist with (and support, and be supported by) a broader ecological community.

Readings:

- *Environmental Biology*, ch 9.5
- “[The Origins of Organic](#)”
- *Field Guide to the Piedmont*, ch. 3
- Sam Knight, “[Can Farming Make Space for Nature?](#)” (*New Yorker*, 17 Feb. 2020)

- Read about the work of [The Land Institute](#) in Salina, Kansas.

Activities:

- **Discussion:** One theme that comes up repeatedly in your reading is *observation*. [Note two ways this has come up. Why does it seem to be important to organic/ecological agriculture specifically? What implications does that have for our agricultural operations?]
- **Research soil microbiology.** What is this field? Why are microbes in the soil important to agriculture? What are three ways a farmer or gardener can encourage their flourishing?

Week 26: Agriculture and human community (Mar 9–15)

Readings:

- Wendell Berry, "[The Work of Local Culture](#)"
- Watch "[Look and See](#)" (we'll watch this together)
- [Explore historical farm consolidation data](#)
- Justin Fox, "[A Productivity Revolution is Wiping Out \(Most\) Dairy Farms](#)" (Bloomberg News)

Activities:

- From the article on dairy consolidation: What the heck is "an economic miracle wrapped in a social tragedy"? Do you think people in rural Wisconsin see this as an economic miracle?

Week 27: Forestry (Mar 16–22)

We covered much of this topic when you read *Ecology of a Cracker Childhood*.

Readings:

- Explore [these links on forest gardening](#)
- [Naval Stores and the Longleaf Pine](#) (Walbert)
- [Naval Stores in Antebellum NC](#) (Olmsted)

Activities:

- With additional time this week, work on research for your spring paper.

Field trip:

- To see restored/managed longleaf pine savanna.
 - [Weymouth Woods Sandhills Nature Preserve](#) has trails through old-growth (400 YO!!) longleaf pine forest and exhibits about the habitat. About 1:15 from Raleigh.
- Response: how does what you've seen reflect what you've learned over the past several weeks?

Field trip: (to be taken later)

- Local hike in Piedmont (or go west?) to apply concepts of forest succession, preservation, traditional uses, etc. Begin researching and writing a natural history of the Eno.
- Find a local example of forest on what was once agricultural land. Based on the trees present, what stage of recovery does it appear to be in? How old would that make the forest? See if you can find historical evidence to confirm your estimate.

Week 28: Grasslands & rangelands (Mar 23–29)

I had planned...

Readings:

- Pollan, *The Omnivore's Dilemma*, ch. 2
- The West — cowboys & farmers, fencing, habitat loss
- [The Dust Bowl](#)

Activities:

Week 29: Fishing (Mar 30–Apr 5)

Readings:

- [Indian Fishing and Hunting](#) (Fort Raleigh/NPS)
- [Fishing in Early Medieval Times](#)
- A.C. Jensen, [A Brief History of the New England Offshore Fisheries](#)
- David Ropelk, "[Atlantic Cod and the Human 'Tragedy of the Commons'](#)" (WBUR)
- [Whales and hunting in the 19th century](#) (New Bedford Whaling Museum)
- Herman Melville, *Moby-Dick*, ch. 61–63, 67 ("Stubb Kills a Whale")
- [Is Sustainable-Labeled Seafood Really Sustainable?](#) (NPR)
- [Marine Stewardship Council Responds to NPR Series](#)

Activities:

Week 31: Mining (Apr 6–12)

Readings:

- No readings this week:

Activities:

- Research: four mined items: say, gold, iron, a rare earth metal, and coal. When first mined and how? What used for today? Who mines them now, where and how? How much is left/has been

used (if we know)? What are the human impacts of mining? What are the environmental impacts?

Week 32: Harvesting from the commons (Apr 13–19)

Readings:

- *Sustaining the Commons*, ch. 6
- David Boller, *Think Like a Commoner*

Supplemental Readings:

These could be used in place of the Boller book if shorter but more example-focused readings are desired.

- [John Berry, Jr., on the Burley Tobacco Program](#) (interview)
- [A Short History of Enclosure in Britain](#) (The Land Magazine)
 - *See also if needed:* [The Enclosure Act](#) (for a very brief summary)

Activities:

- **Response** (either written or for discussion):
 - What are some advantages of individual control of resources? What are some advantages of common management?
 - What preconditions are necessary for a commons to function successfully as a commons? Do they vary from commons to commons? What are some obstacles to making a commons work in the 21st-century United States? What might be some possible solutions?

Unit 4: Resource depletion and pollution

Week 34: Urban space (Apr 20–Apr 26)

In 1800, about 2% of the world's population lived in cities. Today, more than half does.

Readings:

- The [Urbanization](#) page from Our World in Data may be a good starting point (just skim if you like). Otherwise, there is no one good reading I can offer, so you'll have to do some research.

Activity:

- **Research questions:**
 - What are three ways "urban space" is defined? How do these differences affect counts of urban population? Which makes the most sense to you?

- What is an urban “heat sink” or “heat island” and how does it work? Does this have any effect on global climate?
- Urbanization may have both positive and negative environmental impacts. Find and explain three negative impacts that are claimed for urbanization; then find and explain three positive impacts that are claimed. (You need not explain them in great detail, just enough to make clear the reasons for the impact and to give some sense of its scale.) Do these make sense to you (individually and in total)? Why or why not?
- **Lab (cancelled):** I had planned a lab on urban stream health, but given the difficulty of getting out anywhere to do this we will consider that the similar activity the Girl Scouts did last fall will cover the topic.
- With time remaining, work on your spring research project.

Week 35: Fresh water use & pollution (Apr 27–May 3)

Readings:

- *Introduction to Environmental Science* ch. 8 parts 2, 5–7 (based on the table of contents for the chapter; the sections aren’t numbered in the text)
- Water governance: *Sustaining the Commons* ch. 5
- [“‘It smells like a decomposing body’: North Carolina’s polluting pig farms”](#) (The Guardian, Aug. 27, 2019)
- [“To reduce water pollution, NC creates new rules for big hog farms”](#) (News & Observer, Apr. 12, 2019)

Activity:

- As you read, think about these questions for discussion:
 - What did you find particularly interesting in the examples in *Sustaining the Commons*?
 - Based on your reading, would any of the strategies discussed in your textbook reading apply to the problem of water pollution in eastern North Carolina? Why or why not?

Week 36: Air pollution (May 4–10)

Readings:

- *Introduction to Environmental Science* ch. 6

Week 37: Non-renewable energy (May 11–17)

Total energy consumption?

US vs world per capita?

Change over time: growth in e.g. China?

Total needs

Readings:

- *Introduction to Environmental Science* ch. 4

Week 38: Renewable/alternative energy sources (May 18–24)

Readings:

- *Introduction to Environmental Science* ch. 5

Research:

- Research costs & benefits of various renewable energy sources.

Week 39: [work on research paper]

Readings:

- Elizabeth Colbert, *Field Notes from a Catastrophe*

Activities:

-

Week 40: Capstone

Postponed until spring 2021.

Field trip:

- [Elk Knob State Park](#)
- [Roan Mountain National Forest](#)
- [Mount Mitchell State Park](#)