



A Study Guide to Observation and Ecology

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Here we present a series of questions for each chapter that will help stimulate class discussion. Two types of questions are presented for each chapter. “Study Questions” pertain to information that can be found just through a thoughtful reading of the text. They may be the basis for exam questions. “Beyond the Book” questions are designed to foster small research projects which may require finding additional literature, reflecting on past experiences, starting conversations with scientists and non-scientists, or engaging in field exercises. These questions may also be appropriate for group assignments, extra credit reports and “project-based learning” exercises.

CHAPTER 1: AN OBSERVATIONAL APPROACH TO ECOLOGY

Study Questions

1. What are some of the advantages of manipulative experimental approaches to ecology?
2. What is “natural history” and why is it important to the science of ecology?
3. What is the National Phenology Network and why is it important now?
4. How is the new observation-based ecology like and not like the work of early naturalists and ecologists?
5. Name the four “domains” in which observation-based ecology can play a useful role.

Beyond the Book

1. We state that ecology has changed “recursively” from its past state. What is a “recursive” process? What are some examples of recursive processes in nature?
2. Download data from the National Phenology Network (or other online network of ecological observations). For example, you could download all the data on flowering date for a particular plant, or all the data for flowering date for a particular location. See if you can find any trends in the data. Does it work better if you have a question in mind before looking at the data, or if you just explore the data to look for something interesting?
3. Set up a phenological study. Identify at least 5 species from which to take phenological measurements. Decide what phenomena (e.g., budding, first sighting of a migratory species, leaf cover, etc.) you will record and how often. You could follow these species through time or make recordings in different locations on the same day. Create a system for entering and archiving (storing) the data.

CHAPTER 2: OBSERVATIONAL APPROACHES IN HISTORICAL CONTEXT

Study Questions

1. According to this chapter, what are the main phases ecology has gone through and when did they occur?
2. Why did the discovery of the structure of DNA have an impact on ecological science?
3. What have been the publication trends in observation-based studies and experimental-based studies in the leading ecology journals?
4. Experimental approaches led to many successes in ecology, so why should ecological methodologies be changing now?
5. Describe three studies from Table 2.1 that seem most interesting to you. What type of observational approach do they represent?

Beyond the Book

1. Find another scientific paper from the late 1800s (from *The American Naturalist* or another journal). How is it like or different from the paper "Something About Crabs" cited in this chapter?
2. Paul Dayton's paper cited in this chapter features several photographs which show how different our ecological past was from our present. Find three more examples of photographs that demonstrate major ecological changes.
3. Research the biographies of E.O. Wilson and James Watson. How did their careers differ and are there similarities between these two scientists? Which one has been more influential on modern science?
4. Wilson and Simberloff's early experiments on island biogeography required fumigating small mangrove islands so that all animal life was exterminated at the start of the experiment. What ethical questions does this type of experimentation raise? Do you believe the benefits outweigh the ethical considerations?
5. Survey research projects by a set of graduate students and a set of professors at your school or a nearby university. Do the goals and methods of their research differ?

CHAPTER 3: USING ALL THE SENSES IN ECOLOGY

Study Questions

1. What is similar and different about how Geerat Vermeij and Daniel Kish “see” the world?
2. For each of the five senses, describe a way in which they may be important to ecological science.
3. What are some typical attributes of students who are especially good at ecological observation?
4. Why are field notes and drawings important to ecological science?
5. How does scientific ecological observing differ from the normal observing we do in our day to day lives? How can we ensure that our observations are not overly biased?

Beyond the Book

1. Go on a “blind” nature walk. With a friend, take turns being blindfolded and report to your partner what you experience as you explore a natural area. How are you able to move around? What do you hear, feel, and smell?
2. Keep a “scent” journal. What are the different things you smell during the day? What do they remind you of? Do you have difficulty translating smells into words?
3. Listen to recordings of bird songs from your area (many are available online from the Cornell Ornithology Laboratory). Go outside and try to identify local birds from their calls. Keep a list of your auditory “sightings” of birds.
4. Find three scientific ecological articles of studies that primarily relied on (in its methods), or report on (in the studied system), a non-visual sense, and describe their major findings.

CHAPTER 4: USING TECHNOLOGY TO EXPAND OUR OBSERVATIONAL SENSES

Study Questions

1. List five ways in which our own senses may be too limited to answer important ecological questions today.
2. Name one piece of relatively “low tech” equipment, and one piece of modern “hi tech” equipment that has led to a recent ecological discovery.
3. What are some examples of technology giving us the perspective of the organisms we study?
4. Name three potential problems with using technology in an ecological study.
5. How did satellite technology lead researchers to an incomplete conclusion about the state of mangrove forests in Mexico?
6. Why does Carlos Martinez del Rio say that “contemporary natural history is for cyborgs”?

Beyond the Book

1. Conduct a simple ecological study (for example, you might study local animal behaviors or historical changes to a local environment) and present its conclusions without the use of a computer at any stage of the process. What particular challenges arose? Was there any benefit of not using technology in the study?
2. Observe your world through a technological lens. If available, use night vision goggles or an infrared scanner to take observations of the natural world around you. Record things that you saw that you would have missed just using your own senses.
3. Pick a particular ecological phenomena, such as spring leafing or the geographic distribution of species. Find two different papers on this topic—one that uses remote sensing (e.g., satellite or airborne observations) and one that uses more traditional approaches (field observations, field experiments). Do they come to different conclusions, and if so, could the differences be due to the different methods used? What advantages or disadvantages come with each approach?

CHAPTER 5: LOCAL, TRADITIONAL, AND ACCIDENTAL ECOLOGICAL OBSERVERS

Study Questions

1. How do local and traditional knowledge holders differ? Give an example of each.
2. What knowledge do some Seri Indian elders hold that may be useful to science and conservation?
3. What are some limitations of local, traditional and accidental ecological knowledge?
4. What evidence is there that these non-academic sources of knowledge are better or worse than scientists' data?
5. Give two examples of how even very good naturalists have not been able to understand or appreciate large scale ecological changes.

Beyond the Book

1. Discover an example of "accidental" ecological knowledge that hasn't been used before. If you were going to turn this ecological knowledge into a scientific study, what would you need to do with it?
2. Interview an ecological knowledge holder who is not a scientist by training or profession. Examples might include a fisherman, an avid hunter or a logger. What kind of information do they have? Are they able to connect their observations to larger scientific questions like global climate change, invasive species, or loss of biodiversity?
3. Find examples of ecological observing in the recorded stories of traditional cultures. Can these observations be used to track changes between when these stories were first told and today?
4. Find three examples of published scientific papers that rely in part or largely on local or traditional knowledge. Are their conclusions convincing?

CHAPTER 6: DEALING WITH TOO MANY OBSERVATIONS, AND TOO FEW

Study Questions

1. What is a field that is currently producing too many data to use?
2. How did Julie Lockwood and colleagues use historical data to understand biological invasions?
3. What combination of factors can help a study based on historical data provide stronger conclusions?
4. What is the “rich get richer” hypothesis and how did Tom Stohlgren test it in the Rocky Mountains?
5. Why are natural history museum collections important? How can such collections lead to biased results?
6. What is the value of networks of ecological observers?
7. What is “meta-analysis” and how has it been used in ecology?

Beyond the Book

1. Imagine you are the curator of a natural history museum. A biologist emails you to say that he has a wonderful collection of skins of a critically endangered mammal that he would like to deposit in the museum. Do you accept the collection? Why or why not? What else would you like to know about the collection?
2. Write a short (2-3 page) mock proposal to a hypothetical funding agency to support a long term monitoring project for a local species or ecosystem. Indicate why this monitoring program is important now and why it may be important in the future. Estimate how much it would cost to run and maintain this program.
3. Find some examples of recent ecological studies that were analyzed using Bayesian statistics. How does a Bayesian approach mimic the subconscious process of detailed ecological observation?

CHAPTER 7: IS OBSERVATION-BASED ECOLOGY SCIENTIFIC?

Study Questions

1. What is a Popperian approach to science?
2. Why does George Schaller try not to make field data sheets with pre-determined categories?
3. How did Richard Rozzi's near-death experience lead to a new ecotourism experience? What is unusual about the focus of this ecotourism program?
4. Four common criticisms of observational approaches are discussed in this chapter. Select two of these criticisms and discuss counter arguments to these criticisms.
5. Why do Erica Fleishman and colleagues argue that remote sensing data are not enough to draw ecological conclusions?

Beyond the Book

1. Over 1000 papers have cited John Platt's "Strong Inference" paper. Scan through papers that cite "Strong Inference" and find one paper that supports the strong inference approach and one that rejects it, and state their main arguments in a few sentences.
2. Can science be created without hypotheses? Argue for and against.
3. Find three examples of serendipitous findings in the history of science. What was the discovery and from what type of study did it emerge?
4. Read a Sherlock Holmes novel or watch a Sherlock Holmes movie. How does he use deduction, induction, and/or abduction to solve the mystery?

CHAPTER 8: ECOLOGY'S RENEWED IMPORTANCE IN POLICY

Study Questions

1. Give an example of each of the three components of policy making.
2. Give two examples of powerful images of environmental change that were used to change environmental policy.
3. Why was the “nuclear winter” scenario important in later catalyzing action on ozone depleting chemicals?
4. What were the contributions of Svante Arrhenius and Charles Keeling to our understanding of climate change? How do their contributions relate to one another?
5. In what ways can embracing social sciences help connect ecology to policy making?

Beyond the Book

1. What do your local policy makers know? Interview local politicians or candidates for elected office about their knowledge of local and global ecological change. Do they believe there is a problem? Do they have any plans on what to do about it?
2. What is “public trust”? Is there a strong sense that natural resources are part of a public trust in your country or in your community?
3. Conduct a survey of citizen science and citizen knowledge. Do people in your community engage in any citizen science activities (bird counts, water quality monitoring, etc.)? What do people in the community know about local or global environmental issues?
4. Present a scientifically accurate presentation on a local or regional environmental issue to a public forum (city council meeting) or local community group (e.g., Rotary Club, senior citizen community). Provide resources where people can get more information if they are interested or have questions that you cannot answer.

CHAPTER 9: OPENING NATURE’S DOOR TO A NEW GENERATION OF CITIZENS AND ECOLOGISTS

Study Questions

1. What are some of the potential detrimental outcomes of loss of “forest hours”?
2. Why does Brendan Larson advocate a focus on “novel ecosystems” when teaching children?
3. How did Kristin Wisneski and Barron Orr try to integrate technology and nature observation? What are some of the challenges of this approach?
4. What are some of the benefits and limitations of using schoolyards as outdoor classrooms?
5. What are some of the challenges using ecological observations as part of an undergraduate or graduate school education?

Beyond the Book

1. Richard Louv has coined the term “Nature Deficit Disorder”. Is this a real disease? Plot out the basic approach of an epidemiological study to track Nature Deficit Disorder. What would you look for and in what populations of people? What would be your recommendations should your study find that it occurs?
2. Design an urban nature exploration curriculum for young children. What would be the components of a safe, informative and inspiring nature experience for children in your local environment?
3. Do formal nature education programs work? Interview someone who conducts outdoor education programs or an administrator of a program such as “No Child Left Indoors”. What have been their successes and failures? What do they recommend to someone starting a similar program?
4. Describe three nature experiences you had as part of your elementary school education. Why were they memorable? Did they connect to the classroom learning you were doing at the time?