The Nature Experience: What you do is up to you!

C. Riley Nelson, Department of Integrative Biology, Brigham Young University, Provo, Utah 84602. Email: rileynelson@byu.edu
Version: Nature Experience format nelson fall 2009.doc

Abstract
The goals and requirements of a Nature Experience are presented. It will include directed thought, field work, library work, and technical writing. The works of others will be sought and properly cited. The product of this project will be 5-6 pages of text with associated figures and tables. These figures and tables are to be properly cited in the text and include full captions. Plagiarism is unethical and will be avoided. The experience itself will be largely conducted outdoors and include observations of non-human living organisms. These organisms will be properly identified using scientific literature and other field guides. The key to a good nature experience often includes looking in new places or looking in familiar for unfamiliar situations.

Keywords: research paper; sense of wonder; scientific publication.

Introduction
The objective of this assignment is to approach the natural, outdoor world and make observations or perform experiments that lead to personally significant discoveries such as those of Darwin (1839), Nelson and Giuliani (2001), Porter and Savignano (1990), and Stark and Nelson (1994). The combination of observations, experiments, and literature searches is taken together to mean research to most scientists. This is somewhat different from the idea of “research” to many people which means to them simply looking up information that someone else has gathered and rehashing it. When I use the term “research” I mean the first definition, and you should become acquainted with that usage. You will probably do something that has been done by someone else before. Notwithstanding, I expect it to be a novel and exhilarating intellectual experience for you. You will work individually on this project. Team efforts are not desirable or acceptable for this exercise. Others may help you with visiting sites and taking measurements but the ideas are to be your own.

This is much more than a high school “research” paper. It includes substantial directed thought, field work, library work, and technical writing. Each of these four areas contribute to what a scientist refers to as “research”. Research includes original work. To state that you “researched” a topic, in science, means much more than “I looked up the written works of others and accepted their results”. It requires original thought in the context of an unfamiliar problem.

The product of this experience will be a 5-6 pages of text (double spaced and typed. You will include at least one Figure and one Table, properly cited in the text. Figures and Tables will have captions formatted to “stand alone” so a reader can get the basic ideas in them without referring to the text. I also require that you include five properly formatted references, taken from primary scientific literature (not general references such as textbooks, encyclopedias, or internet citations). Again, internet citations do not fulfill the five references requirement. These references must be relevant
to what you saw or did not simply more information on a keyword that isn’t related well to your question at hand. Simple copying or paraphrasing of large blocks of others work is not acceptable. That is plagiarism and unethical. It is also plagiarism to use the works of others without cited them properly. This is the small thanks scientists get for the work they do, don’t rob them of that credit. For some basic rules of citing scientific research of others and the “Name-Year” citation style consult McMillan (1997). You can look in the literature cited sections in the journals Ecology, Western North American Naturalist, and the Annals of the Entomological Society of America if you are unfamiliar with this style. Note that this is part of a very commonly used style in scientific writing and it is not MLA or some other format you may have learned and loved. Format your entire paper properly for full credit. You will learn much from the experience of a literature review using the search engines provided at the Brigham Young University (BYU) Library website.

Materials and Methods
Most of your data gathering will take place in the outdoors by observing non-human living things. These are exact requirements for this assignment. You do not need to go to an exotic place to have a Nature Experience, but you do need to be looking for new things. The mountains, canyons, lakes, and streams surrounding Provo are ideal as sites for these observations and experiments. Please move into a wild area for your observations, not merely a garden area around campus or your apartment. You might look through the titles and abstracts done by others in past classes. I will place examples on reserve in the Lee Library and at least some at our class website. Note, however, that these examples may violate some of the requirements I state in this report. The authors of those examples may have been penalized for not following instructions.

Part of knowing what to look for depends on knowing what you are looking at. If you know the names of organisms and something about what they do then you can build on that knowledge. Your teaching assistants and I will help you identify things. Where possible, collect a specimen, a photograph, or a bit of the plant for identification. Make sure you have permission to do this, some areas such as state and national parks do not allow specimen collecting. Correct identification of the organisms is absolutely essential.

Use descriptive and comparative statistics when possible. They are often an integral part of research efforts. Scientists work very often in a probabilistic world. You need to become familiar with statistical concepts. Never misuse the term “significant” in a scientific paper. Use of this term connotes that a statistical test has been performed. Consult a statistical handbook, such as Zar (1996) for a detailed explanation. The term “significant” in a scientific paper does not usually mean “important to human efforts”.

You can easily make a discovery about nature in some very familiar place. So you might go to a familiar natural area. However, you may be more likely to see something that interests you if you go somewhere you have never been. It may be more interesting if you go to a familiar place at a different time of day or look at smaller and larger things than you typically notice. For example, some of the best bird watching can be done just as the sun is rising; some interesting organisms are small, but visible, around you; plants may be distributed in clumps or bands along gradients of water, temperature, altitude, or latitude. Part of what I am encouraging you to do is to be creative and expand your
experiences in the outside world. In any event, this should be enjoyable. If it is not enjoyable then perhaps you should change your attitude.

Results

Here is an example of the process of a nature experience. I spent about half an hour walking trails around the Provo River and found many small insects walking on the ice and snow. This seemed odd to me because I had heard that insects were cold-blooded and could not survive cold winter temperatures. I noticed that some of these insects had long wings and others had short wings. I began to wonder how short wings could be of any advantage to these insects. To me, the wings were much too short to allow those individuals to fly. It seemed that flying could be very important to the insects so that they could get from place to place quickly. Why did they have short wings? Additionally, I looked closely at these insects and saw that tiny red dots covered some of them. When I got a hand lens and examined these dots closely they had legs! They looked like ticks. I remembered hearing that ticks suck blood and can transmit disease. Next I wondered whether insects had parasites and whether these parasites could transmit disease to insects. That observation started me thinking about parasites of all kinds. Most observations of this sort lead to more questions and suggest further research. These questions lead especially to some very interesting ultimate questions ("why" type questions) that are much more difficult to answer and require detailed observations. Thus, the beginning of the experience can be quite simple. From the insect example above I can see about 10 different Nature Experiences! How you test your ideas and hypotheses simply can be much more challenging. Do not hesitate calling and asking for suggestions. Do not assume you need expensive equipment. You will be responsible for getting your own equipment. Be opportunistic, watch what is happening around you as you move around from day to day. You never know when the right project will stare you in the face. Pay attention to nature programs on television and question what the people are telling you. Try to test their ideas using plants and animals in your own area.

Note that the Literature Cited section below contains references to all works cited in this example paper. It includes many books as well as primary reference citations. Your primary research paper should have more primary reference citations than this overview.

Discussion

In summary, the process of starting a nature experience might go something like this: go to some interesting local place and start looking around. It would probably be helpful to bring along a guide book or two (Griggs 1997; Harris 1973; Levi & Levi 1968; Ransom 1981). Find some binoculars if you want to look at birds, or an insect net if you want to look at small mobile animals. After looking around you might notice something interesting. Look for some phenomena that you have never seen before or an organism doing something that you had never noticed. You might also keep in mind major ideas you learned in ecological portions of your biology classes, such as predation, competition, production, and species richness. Collect a bit of descriptive data (ALWAYS CARRY A FIELD NOTEBOOK TO RECORD DATA AS YOU SEE IT.) You could then come back and get the organisms identified. For plants and insects you would probably want to collect a bit of it. Figure out the scientific name of the beasts as
best you can and read about them (for example, where they are found, what they do, etc.). Develop some ideas about what you think is going on or what the consequences are of what you have observed. Try to put your project in the context of "big questions" in ecology and natural history. We will discuss some of these "big questions" during the first few class sessions. Do some reading on the things you saw to see what others have done or observed. Learn to use the computer assisted literature searches and abstracting journals in the library. The best sources are BIOSIS, Biological Abstracts, Zoological Record, and Science Citation Index. These will be very valuable. Be sure to ask librarians for help with these searches. Many of these searches are available on-line at the BYU Library web site.

Then you might revisit the place to verify your notions of what is happening and maybe take some pictures or perhaps do a drawing. You will probably need to make several visits to the site. You should design your observational scheme carefully before attempting to express your ideas or feelings in an organized report. I am particularly interested in having you record your observations, not necessarily those that others have found. This will require much effort on your part. Make this exercise more than simply an assignment. Open your mind.

We would like you to write up the Nature Experience in the format of a scientific paper. Your written treatment will probably be shorter than most reports you see published in journals. At some point in your paper answer who, what, where, when, why, or how.

What you do for this nature experience is up to you!

Literature Cited
Nature Experience Grading Criteria

1. Originality: The choice of topic shows original thought or a novel approach to an old problem.
   5 points.

2. Background: The related projects of others are properly noted and cited in the text and in the correct format in a Literature Cited section.
   10 points.

3. Design: An observational or experimental design is chosen which eliminates many variables and focuses on a finite question.
   15 points.

4. Execution: The implementation of the original idea and design is attempted in a way that is reproducible.
   20 points.

5. Presentation: The written and graphic portions of the paper are neat and well-organized.
   10 points.

6. Analysis: The results of the execution are examined and summarized to the reduction level that is appropriate.
   10 points.

7. Format: A standard format for a scientific paper is followed, or an appropriate format is designed.
   10 points.

8. Grammar: Grammar, spelling, and typographical errors are such that they do not distract from the flow of the presentation.
   10 points.

9. Electronic copy of Title, Your name, address, Abstract, and Key Words. Send to your teaching assistant.
   10 points.

Total: 100 points.
Preparation of the Nature Experience report

A good source for reading about report writing format is: Writing Papers in the Biological Sciences, Second Edition, by V. E. McMillan (1997). This book will give you choices for a variety of formats, but all seek to standardize technical writing for the benefit of future readers. We will get several copies of this book and put them on reserve in the library. Follow the styles used by the journals listed in the Literature Cited section below. Your paper will almost certainly include the following sections:

**Title:** State the work and attract the reader's attention. Include words that will allow for a useful computer search later.

**Name and address:** Who is the author of the paper and where might the author be contacted. For our purposes an email address should also be included.

**Abstract:** This is a brief summary of how the study was done and what are its main findings.

**Keywords:** Include words that would be useful in a computer search of your work. Add key words that are not included in the Title or Abstract.

**Introduction:** Introduce the topic giving the general context of your observations and the phenomena. You might also include an overview of what others have seen, as recorded in the literature.

**Methods and Materials:** Describe how you made the observations including time, date, duration, and any methods you might have used to get the data. List any important or unique pieces of equipment that aided in your project.

**Results:** Describe what you observed. Be very precise and factual. Summarize data as tables and figures, cite them in your text and provide proper captions for them. Include no speculation or interpretation in this section. Give just the facts, please.

**Discussion:** Review and interpret your general findings, especially considering what other people have found. You are obligated to give your own interpretation for the data you gathered. Some speculation is appropriate here to spur interest in future research. You may discuss some questions raised by your observations that you think deserve further investigation. Note any inconsistencies or ambiguities between your observations and published accounts.

**Acknowledgements:** Give thanks to those who may have helped you in any way. Perhaps include people who gave you key ideas, people who helped you in obtaining field data, sources of funding, and people who helped you prepare the report. A little gratitude goes a long way to ensuring future harmony with friends and professional colleagues.

**Literature Cited:** Give proper bibliographic citations for work related to your topic. The format of references should follow the standard format found in such journals as American Naturalist, Evolution, Ecology, Southwestern Naturalist, or Western North American Naturalist. We call this the Name-Year system. Check out how to use it by reading “Writing Papers in the Biological Sciences, Second Edition, by V. E. McMillan, 1997”. This text gives examples of the format of a variety of sources. In addition, see the Literature Cited section in “The Nature Experience: What you do is up to you!” handout (Nelson 2004) for a variety of generic and appropriate Name-Year citation examples.
Summary of minimum requirements for Nature Experience
Use formal English style in your writing, not conversational language. Additional figures will enhance your report. Include at least five references (probably more), in the proper format, for your Nature Experience. Most of these should be primary literature sources. Prepare the report in the format of a scientific paper.

1. Nature experience proposal for research due in class and credit will be given for this brief, typed proposal. Note that your subject needs to be outdoors and using non-human organisms. You will benefit from our comments so the more detail you include at the proposal phase the better off you will be in the end. Avoid procrastination. I also suggest you show your teaching assistants or me a draft of your report at least two weeks before the final due date listed in the syllabus.

2. The written report and emailed summary of the Nature Experience are due as noted in the syllabus. This report will consist of 5-6 typewritten, double-spaced text. In addition you must include at least one figure as a graph of data, a photograph, or a drawing. It must also include one table of data. You will need to email your teaching assistant a copy of your project's Title, Your Name, Your Address, Abstract, and Key words. I could be posting these abstracts on the web for future reference so please follow the exact format for spacing and font (Times) in this example:

Population size estimates of an isolated laboratory colony of Tenebrio molitor Linnaeus (Insecta: Coleoptera: Tenebrionidae).

C. Riley Nelson, Division of Biological Sciences and Brackenridge Field Laboratory, University of Texas, Austin, Texas 78712. rileynelson@byu.edu

Abstract
I estimated size of a population of Tenebrio molitor taken from colonies at the Brackenridge Field Laboratory of the University of Texas at Austin, using three techniques: the hand graphing method, the two sample method, and linear regression analysis. The graphing method yielded a population estimate of 200 individuals. The two sample method gave an estimate of 181 individuals. Linear regression analysis produced an estimate of 210 individuals. The true population size was 200 individuals. In this case, the graphing method had no deviation from the true population size. Use of the two sample method underestimated the population by 19 individuals (9.5%). Linear regression analysis overestimated the true population by 10 individuals (5.0%). Based on my observations the general reliability of the three methods rank: graphing > linear regression > two sample. I noted an apparent violation of a basic assumption of removal sampling techniques but offer no explanation.

Key words: population sampling, estimation, regression.

---Failure to submit this electronic information will result in loss of points.

4. See me often for suggestions.
5. See me often for suggestions.
6. Contact me regularly for helpful comments. Get the picture?
Scientific Papers: writing suggestions

We will consider both content and presentation in evaluating your papers.

Please consider the following good writing habits:

1. Make no grammatical or style errors. Particularly watch for the problem areas:
   Use correct verb tense.
   Make sure the subject and verb of the sentence agree in number (for example: It is, They are . . . not It are, They is. This is tricky with complex subjects).
   Use of first person (I, We) is acceptable, avoid lengthy substitutes. If you use “We” be sure you have already let the reader know who “We” is.
   Avoid the passive voice. (Not "The samples were counted." but "I counted the samples.")
   Avoid vague statements.
   Avoid redundant phrases.
   Write complete sentences.
2. Type on good quality paper.
3. Use 1 inch (2.5 cm) margins on all sides.
4. Use metric units of measure in the body of the paper.
5. Do not abbreviate words except units of measure.
6. Make no spelling or typographical errors.
7. Number all pages starting with page 2.
8. Number and cite all figures and tables consecutively as they appear in the text.
9. Place the caption for Tables above the table and give enough information so that the table can stand on its own without reference to the text.
10. Place caption for Figures below each figure.
11. Cite references in your text, where appropriate, as author and year (also known as Name-Year) of publication (e. g. Lagowski 1987). See journals such as Evolution, Ecology, or Annals of the Entomological Society of America for other examples. Be consistent in form. Don’t use irrelevant citations.
12. Give complete citation for each reference in the "Literature Cited" section of your paper. List only those references actually cited in the text. Use the format of journals such as those listed above.
13. Give the scientific name (where possible) of the organisms studied along with an acceptable common name (if available).
14. Capitalize the Genus name (plural is genera) but the species name is all in lower case letters. Italicize both parts of the name. (e. g. Homo sapiens, Musca domestica, Cichlasoma nigrofasciata)
15. Have someone else proofread your paper. They may see inconsistencies of form or typographical errors that you missed. Learn to use spell and grammar checkers that are parts of many word processing programs.
16. Choose each word in your title carefully. Attract the reader and give key words for retrieval later. Your words are becoming timeless. Perhaps this is your immortality, to be considered the wisdom of the ages. Work carefully.