



## The Field Book Project



The Field Book Project's mission is to create one online resource for biodiversity field books. Funded by the Council on Library and Information Resources, the Field Book Project is a collaboration between the Smithsonian Institution Archives and the National Museum of Natural History.

### Create Your Own Field Books Lesson Plan and Activity

- Objectives:** 1) Introduction to field notes, scientific observation, and field research  
2) Familiarity with scientific concepts and vocabulary
- Content Area:** Science, Biology
- Activity Time:** **K-3:** 15-30 min in class or as homework; 1-5 specimens  
**6-8:** 40 min-1 hour in class or as 3 day homework assignment; 5-10 specimens  
**9-12:** 1-2 hours in class or as week-long homework; 10+ specimens
- Materials:** 1) Notebook and pencil/pen 2) Camera 3) Color pencils or crayons (if drawing)

#### Overview

Knowledge of the living world begins with scientific observations recorded in field notes. When biologists collect specimens to study, they keep field notes in which specimen names are recorded along with observations about the specimen, the collecting event, and the surrounding environment. Occasionally, drawings or photographs supplement written documentation.

Observation is essential to field research. Scientific observation requires the use of senses to receive information about the specimens collected and the context in which the specimen is collected. Observations can be wrong, for example, when our senses fool us or when biases and assumptions cloud our perception. To aid their senses, scientists often employ instruments to obtain data about specimens like size, weight, sound or other characteristics. Instruments also aid scientists in capturing contextual information like time, temperature, altitude, coordinates, and other aspects describing when, how, and where specimens were obtained.

#### Types of Observations during Field Research

Location: Observations of location range from general observations about the state and city to more specific observations like the name of a river, miles or paces from a landmark, or geographic coordinates.

Date and Time: Biologists often observe the date and time that specimens were collected.

Physical Characteristics: **Color** is important because sometimes specimen colors, as on fish for example, fade after being collected. Biologists pay attention to **measurements** like length, height, or weight.

**Sound** is also important to observe because that is how many animals communicate.

Photos and Sketching: Biologists often use photographs to remember what specimens and their surrounding environments look like. Many biologists also rely on sketches, even if they have photographs, because of the immediacy of sketching a drawing in a notebook. Sketching also allows biologists to depict certain concepts that are difficult with photographs.

Download on the Field Book Project Website: [www.nmh.si.edu/rc/fieldbooks/education.html](http://www.nmh.si.edu/rc/fieldbooks/education.html)

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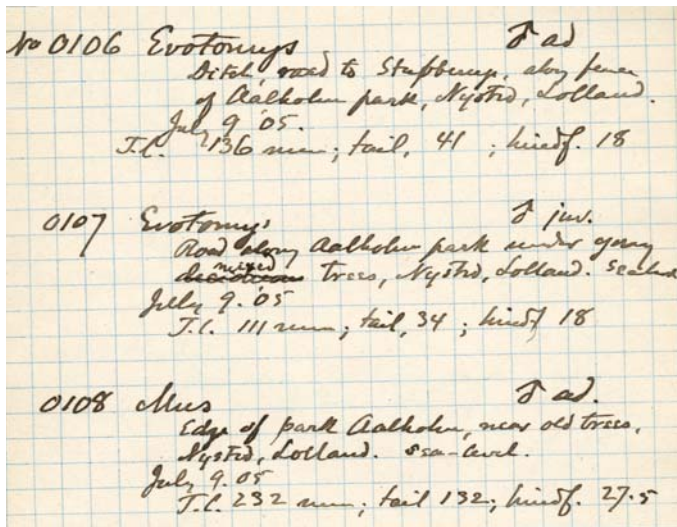
**Taxonomy and Classification:** As biologists collect specimens, they write down the common name or scientific name of the specimen and give that specimen a number. Scientific names are based on **taxonomy**. Taxonomy is the study of **scientific classifications**, which is grouping living things into categories based on shared evolution and characteristics. Every living thing belongs to several categories of life. For example, humans belong to the group Animals, but we also belong to the group Mammals. Every living thing has also has a **binomial**, which is a two part names consisting of genus and species. Ex. Humans: *Homo sapien*. The other commonly used levels of classification above genus and species are Kingdom, Phylum, Class, Order, and Family.

**Environmental and Contextual:** Environmental context helps biologists learn about how specimens live. Biologists sometimes observe the **weather** for clues about a specimen's environment. Observations can be general ("cool"; "hot"; "rainy"; "very dry") or specific (30°F; wind 20mph; 1inch rainfall). Biologists also observe characteristics of the **environment** surrounding a specimen. Is the specimen found above a certain altitude? Does it live in mud? Does the specimen live in decaying material? Underneath tree bark, in a hole, or under a rock? Observing general or specific **quantities** of specimen can also tell biologists how common, abundant, or scarce specimen are, which provide clues about where specimens thrive.

### What are Field Notes?

Physical characteristics, sketches, scientific names, environment, location, date, time—that's a lot to remember! Biologists write down their observations in field books or field notes. Field notes contain the name of specimens and observations biologists made about those specimens. There are many kinds of field notes. Specimen lists and journals about collecting are two common types.

Specimen lists usually contain numbers corresponding to names of specimens. Sometimes they also include locations and other observations. In the specimen list below, numbers correspond to the names in the list, and location or habitat information is sometimes recorded below.



**Figure 1. Leonhard Stejneger's field notes**

No 0106 *Evotomys* ♂ ad  
Ditch, road to [?] along fence of Aalholm park, Nysted, Lolland. July 9 '05. T.I. 136 [?]; tail, 41; hind f.18

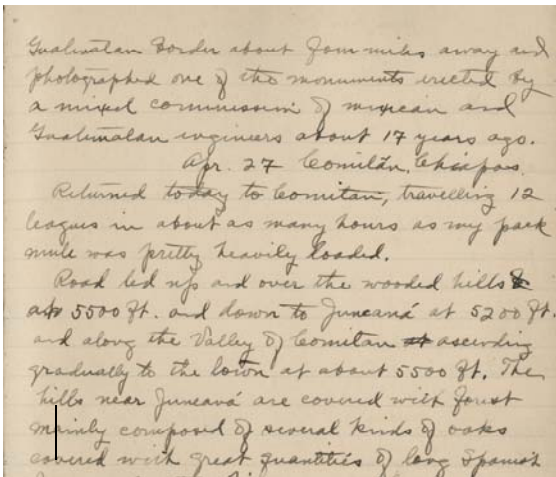
0107 *Evotomys* ♂ juv.  
Road along Aalholm park under the [young?] trees, Nysted, Lolland. Sea-level. July 9 '05. T.I. 111 [?]; tail, 34; hindf. 18.

0108 *Mus* ♂ ad  
Edge of park Aalholm, near old trees, Nysted, Lolland. Sea-level. July 9 '05. T.I. 232 [?]; tail, 132; hindf. 27.5.

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Journals or diaries from field research often have a mixture of personal and scientific information. They contain observations of all kinds and are usually narrative and chronological. They may include detailed descriptions of the routes biologists travelled and descriptions of what they saw as seen in Figure 2.

Journals can also provide anecdotal notes about where and how a specimen was found, revealing details about the specimen's habitat and habits, as shown in Figure 3.



Guatemalan border about four miles away and photographed one of the monuments erected by a mixed commission of Mexican and Guatemalan engineers about 17 years ago.

Apr. 27 Comitan, Chiapas.

Returned today to Comitan, travelling 12 leagues in about as many hours as my pack mule was pretty heavily loaded.

Road led up and over the wooded hills at 5500 ft. and down to Juncana at 5200 ft. and along the Valley of Comitan ascending gradually to the town at about 5500 ft. The hills near Juncana are covered with forest mainly composed of several kinds of oaks covered with great quantities of long Spanish [...]

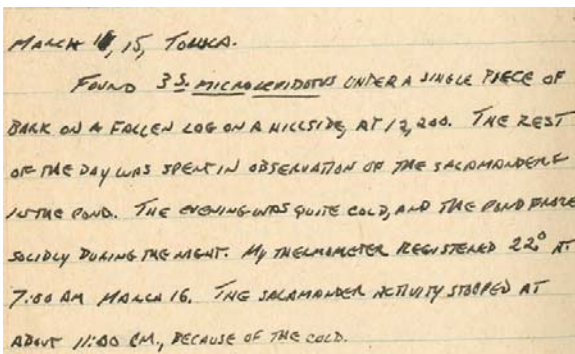
**Figure 2. Edward Alphonso Goldman journal, 1893.**

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MARCH 15, 1949, TOLUCA.

FOUND 35 *MICROLEPIDOTUS* UNDER A SINGLE PIECE OF BARK ON A FALLEN LOG ON A HILLSIDE AT 12,200. THE REST OF THE DAY WAS SPENT IN OBSERVATION OF THE SALAMANDERS IN THE POND. THE EVENING WAS QUITE COLD, AND THE POND FROZE SOLIDLY DURING THE NIGHT. MY THERMOMETER REGISTERED 22° AT 7:00 AM MARCH 16. THE SALAMANDER ACTIVITY STOPPED AT ABOUT 11:00 PM, BECAUSE OF THE COLD.

**Figure 3. Journal of James A. Peters, 1949.**

March 15, [1949] Toluca.

Found 35 *microlepidotus* under a single piece of bark on a fallen log on a hillside at 12,200. The rest of the day was spent in observation of the salamanders in the pond. The evening was quite cold, and the pond froze solidly during the night. My thermometer registered 22 degrees at 7:00AM March 16. The salamander activity stopped at about 11:00PM, because of the cold.

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Less typical field notes may include photographs, sketches, maps, and field correspondence. Examples of each are shown below.



Figure 4. Laysan albatross, Laysan Island, circa 1961-1973.



Figure 5. Sketch and description of *Callicanthus lituratus*, 1901.

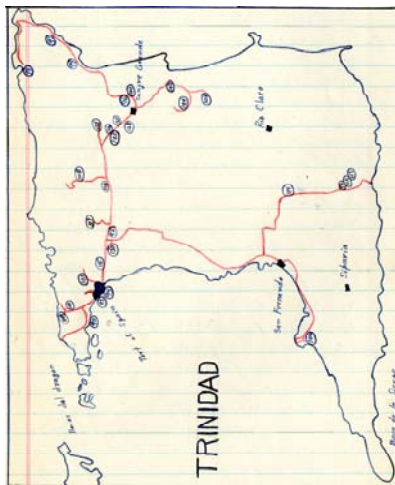


Figure 6. Traced and annotated map of Trinidad, 1935.

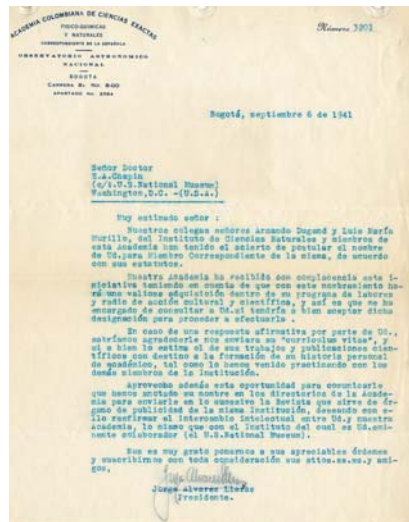


Figure 7. Letter to Edward A. Chapin from Jorge Alvarez Lleras, 1941.

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### Determinations

Determinations are identifications of the taxonomic name of a specimen. Biologists sometimes cannot fully identify a specimen during collection. They may know the genus, but not the species, or identify the specimen incorrectly. Determinations are done after the specimen is collected, sometimes in a lab and sometimes by another scientist, to confirm or supply taxonomic names.

### Classification

KPCOFGS stands for **K**ingdom, **P**hylum, **C**lass, **O**rders, **F**amily, **G**enus, **S**pecies. This mnemonic is useful for remembering **KPCOFGS**: King Phillip Comes Over For Good Soup

### Terms

**Observation**: receiving knowledge of the outside world through our senses, or recording information using tools and instruments. <http://www.experiment-resources.com/scientific-observation.html>

**Field notes**: records of field events leading up to and including the collection of specimen.

**Specimen**: A portion of or entire life form collected for testing, examination, or study. For example, a plant or animal (entire life form) or a leaf or bone (portion).

**Classification**: systematic arrangement into groups or categories according to established principles.

**Binomial**: the two part name of a living thing that includes its genus and species.

**Determination**: identifying the taxonomic name of a specimen.

### **Image credits:**

**Figure 1**: Descriptions of reptiles and amphibians with specimen numbers from Europe (1905) and Virginia (1906). Smithsonian Institution Archives, Record Unit 7074, Stejneger, Leonhard, 1851-1943, Leonhard Stejneger Papers, box 26, folder 4.

**Figure 2**: Mexico, April 4 - August 10, 1893. Smithsonian Institution Archives, Record Unit 7364, Edward William Nelson and Edward Alphonso Goldman Collection, box 26, folder 4.

**Figure 3**: Field notes : Mexico, 1949. Smithsonian Institution Archives, Record Unit 7175, Peters, James Arthur, 1922-, James A. Peters Papers, and Records of the Division of Reptiles and Amphibians, box 49, folder 6.

**Figure 4**: Smithsonian Institution Archives, Record Unit 245, box 230, folder 13. Negative number SIA2011-1358

**Figure 5**: Smithsonian Institution Archives, Record Unit 7184, box 16, folder 8. Negative number SIA2011-1233.

**Figure 6**: Smithsonian Institution Archives, Record Unit 7184, Accession 96-099, box 1, folder 7. Negative number SIA2012-1209.

**Figure 7**: Field notebook, Colombia, 1941-1942. Smithsonian Institution Archives, Accession 11-085, box 1, folder 2.

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### Instructions for Teachers

Discuss the concepts outlined above with your students. For 7<sup>th</sup>-12<sup>th</sup> grades: allow students to read the overview before class discussion.

- 1) Observation. Explain this concept and ask your students to provide examples of how they observe objects or how they use senses to observe.
- 2) Observation methods. Review the various types of observations biologists make and ask your class to take a minute to make some of those observations about themselves or a nearby object.
- 3) Field notes. Explain what field notes are and their purpose and usefulness.
- 4) Determinations. *Deemphasize taxonomy, classification, binomials, and perhaps determinations for younger students.* Review the concepts of classification with your class. Share with them the KPCOFGS example from above or make your own. Encourage students to make their own mnemonic device or create one together as a class.

#### Activity

Students will “collect” specimens and record notes on their findings. Limit “collecting” specimens to observing, noting, and taking photos of specimen. For older students, actual specimen collecting may be an option dependent upon school policies, local, state, and federal laws<sup>1</sup>, scope of the course, and personal preferences of students, parents, and teachers. **Limit actual collecting to plants.** Do not collect in national, state, or municipal parks. School grounds are encouraged for collecting. Ask a trusted local resident to volunteer their yard or contact organizers of community gardens nearby as an alternative. Before starting, make sure your students have a clear idea of what they intend to observe, whether from a variety of kingdoms, one kingdom, or lower classification.

**Alternatives:** If outdoor collecting is not an option have samples of specimens set up at stations around the classroom for the students to observe and identify. Also, surrogate specimens (photographs or drawings of specimen) can be used for these exercises in the place of actual specimen.

**Photographs and Illustrations:** photographs of specimens are needed for students to conduct research after the activity. In the absence of cameras, descriptions should be more detailed and perhaps include illustrations. Review strategies for description and illustrating before the activity, and perhaps involve your school’s art teacher to create an interdisciplinary project.

#### Classroom

After the activity is completed, students use their notes to make determinations, or identify specimen. Students can compare their notes to an identification chart or textbook to learn what their specimen might be. For younger students, this may involve confirming that they found a “maple leaf” or discovering that their “butterfly” is really a “monarch butterfly”. For older students, scientific names

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<sup>1</sup> Some federal and local laws prohibit or restrict collecting specimens altogether or without a permit. Examples include the Migratory Bird Act and the Endangered Species Act. Students may not know which species are endangered, so knowledge of endangered species in your area is encouraged.



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might be optional, extra-credit, or required. Middle school students might be expected to determine Family level or higher. High school or AP students might attempt to determine genus or species.

### **Resources for classroom research**

**EOL** (Encyclopedia of Life) <http://www.eol.org> is a free on-line resource that provides “a webpage for every species.” EOL brings together trusted information from resources across the world such as museums, learned societies, expert scientists, and others into one massive database and a single, easy-to-use online portal. EOL is also fully internationalized with interfaces provided for English, Arabic and Spanish language speakers. Go to EOL, type in a species name and start exploring! (K-12<sup>th</sup>)

**UBIO** <http://www.ubio.org>: Search common names to get taxonomic names in this database. (7<sup>th</sup>-12<sup>th</sup>)

**Advanced Mobile Technology Option:** The Leaf Snap iPhone app allows anyone to photograph a plant and upload it to the Leaf Snap database with minimal information. Scientists then enhance the information about that plant. Learn more at Leaf Snap: <http://leafsnap.com/>

**Downloads and Additional Resources:** Download and modify the lesson plan, and see additional resources here: [www.nmh.si.edu/rc/fieldbooks/education.html](http://www.nmh.si.edu/rc/fieldbooks/education.html).

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## Student Instructions for Grades 3-6

### Vocabulary

**Specimen (biology):** A portion of or entire life form collected for testing, examination, or study.

**Sketch:** A quick drawing that gives you a basic idea of what something looks like.

**Description:** Words or other tools used to tell about an object or event. Descriptions help a person who did not see the object or event to imagine what it was like.

**Location:** A place where something is or something is happening.

**Observe:** to notice characteristics about something by looking at it or using your other senses.

### Let's get started!

What are you going to observe? Plants? Animals? Both? Or do you want to observe only one kind of animal like insects or birds?

1. Look at, but do not touch specimen unless your teacher says it's OK.
2. Find a *specimen* to *observe*. Hint: You may have to look in the sky, under a rock, in puddles, or on trees.
3. Take a picture with your camera or draw a *sketch* of your specimen
4. Give a *Description* of your specimen and where you found it. Use questions below to help you.
  - a. What type of plant or animal is it? Examples: "flower"; "tulip"; "butterfly"; "monarch butterfly"
  - b. What's the *location*? Where did you find it? Examples: "Rock Creek Park"; "On Main Street between 1st and 2nd street"; "In my back yard underneath the cherry tree"
  - c. What's the description? What does it look like? What color is it? How big is it? What looks interesting about it?
  - d. What other notes can you add? What time did you find it? What was the weather like when you found it? Was it muddy or dry where you found it?
5. Collect 5 specimens total.
6. When you go back to the classroom, your teacher will help you learn more about what you collected. For your specimen, try to answer the following questions
  - a. Did you collect any plants? What are their names?
  - b. Did you collect any animals? What are their names?
  - c. Did you collect fungi? What are their names?
  - d. What are some interesting facts about your specimens?



## Student Instructions for Grades 7-12

### Vocabulary

**Specimen (biology):** A portion of or a whole organism for use in testing, examination, or study.

**Rarity:** The quality, state, or fact of being very uncommon (Merriam-Webster)

**Abundance:** A large quantity.

**Classification:** Systematic arrangement into groups or categories according to established principles.

**Taxonomy:** The study of classifications.

**Getting Started:** What do you plan to observe? Do you want to observe plants and animals? Only plants? Only animals? Do you want to observe only one kind of animal like insects or birds?

### Instructions—Read instructions through at least once before beginning

1. Look at, but do not touch specimen unless otherwise instructed by your teacher.
2. Find a *specimen* to observe.
3. Take notes about your specimen. Be sure to include the following:
  - a. Common name. The non-scientific name of the specimen. Ex. bull frog; sunflower; trout; lark.
  - b. Taxonomy. What Kingdom does it belong to (ex. animal; plant; fungi)? Can you identify a lower level of *classification* for the specimen? For example Frogs are part of the Amphibian class.
  - c. Location of the specimen. Include both general and specific descriptions if possible. Examples: “Washington, DC”; “Tree Park, 1 mile from the head of Green Trail”; “50° 23’ N, 100° 33’ W”.
  - d. Describe the specimen. What does it look like? What color is it? How big is it? What looks interesting about it? What do you *think* it feels like? (**Do not touch specimen unless instructed by your teacher**. Instead, use visual clues to guess at what specimens feel like.)
  - e. Quantity, Abundance, and Rarity. How many are there? Are they common, abundant or rare?
  - f. Other observations. What was the weather and temperature like when you found it? Was the surrounding environment of the specimen like? Muddy? Dry?
4. Collect **5-10 specimens** total.
5. Make determinations using the resource provided by your teacher. For each of your specimens:
  - a. Check the common or scientific names you gave your specimen. Correct the name of your specimen if you didn’t get it right the first time.
  - b. Once you’ve correctly identified your specimen, try to find more specific information. Can you place your specimen into an even smaller classification?

**1. Name of Specimen:**

Location:

Description:

Other notes:

**2. Name of Specimen:**

Location:

Description:

Other notes:

**3. Name of Specimen:**

Location:

Description:

Other notes:

**4. Name of Specimen:**

Location:

Description:

Other notes:

**5. Name of Specimen:**

Location:

Description:

Other notes: