

## HELP BEHIND-THE-SCENES AT A MUSEUM AS A CITIZEN SCIENTIST

**Grades:** 9-12

### Aligned Standards

#### Florida State Standards

*The Practice of Science:* SC.912.N.1.4: Identify sources of information and assess their reliability according to the strict standards of scientific investigation.

A: Scientific inquiry is a multifaceted activity; The processes of science include the formulation of scientifically investigable questions, construction of investigations into those questions, the collection of appropriate data, the evaluation of the meaning of those data, and the communication of this evaluation.

*Evaluation of digital information resources:* SC.912.CS-PC.3.4: Analyze and evaluate public/government resources and describe how using these resources for communication can affect change.

#### Next Generation Science Standards

HS-PS4-2. Evaluate questions about the advantage of using digital transmission and storage information.

### Summary

Students will learn about the importance of biodiversity research collections (specifically, herbaria), the types of data that their specimens hold, the process of digital data creation about the specimens, and the online publishers of that digital data. Students will act as citizen scientists and transcribe labels of plant specimens then explore the research value of the data that they create.

### Objectives

After completing this lab, students will be able to

- 1) Identify why biodiversity research collections are important,
- 2) Complete transcriptions of specimen records as a citizen scientist to aid in the digitization of biodiversity research specimens,
- 3) Recognize that online publishers of the digital data about biodiversity research specimens are available,
- 4) Understand the implications digital data can have for researchers, natural resource managers, policy makers, and them.

### Required Materials

- 1) The teacher will need a large monitor or projector attached to a computer with internet connection to show online video and other online content.
- 2) Each student will need their own computer and a copy of the worksheet.

### Teacher Preparation

- 1) Read through the lesson plan.
- 2) Watch the video "Library of Scientific Plant Samples: Step inside an Herbarium" (<http://www.cpalms.org/Public/PreviewResourcePerspectivesVideo/Preview/166547>) and, if

there's time, "Crowd-sourced Herbarium Data Transcription"

(<http://www.cpalms.org/Public/PreviewResourcePrespectiveVideo/Preview/166555>). The students will watch the former video as a part of the lesson.

- 3) Transcribe two (or, if there's time, five) specimens at Notes from Nature (<https://www.notesfromnature.org/active-expeditions/Herbarium>; [select one of the WeDigFLPlants projects, if there is one, or a different project, if there is not](https://www.notesfromnature.org/active-expeditions/Herbarium)), reading through the tutorial and the "Need some help with this task" content for each field.
- 4) Visit the iDigBio Portal (<https://www.idigbio.org/portal/>) and the USF Plant Atlas (<http://florida.plantatlas.usf.edu/>) and try the searches that are described in the Q&A below and the worksheet, respectively. You can use the example "Pinus palustris" for both searches.

### Background for Teachers

For centuries, scientists have explored and documented the natural world, collecting the ca. 3 billion specimens currently housed in museums, universities, and field stations worldwide. These include fossils in boxes, fish in jars, insects on pins, plants on sheets, and many other collection types. Each scientist labelled their specimens with the what, when, and where of the collecting event. The scientific community has recognized the importance of representing this label data in digital form to make it available online for discovery and aggregation into datasets to address pressing research, conservation, natural resource management, public policy, and other types of questions. Without this online, digital representation of the label data, the data largely languishes behind the scenes at museums and other institutions curating the collections. With this digital resource, we can produce a detailed historical baseline for understanding the distribution and diversity of life today and in the future.

While compelling as a data-creation activity, the sheer scale of the task precludes quick completion without help, and scientists have recently begun inviting volunteers to join them in the task. These volunteers are often called "Citizen Scientists." Citizen science welcomes new participants into the scientific process, often with the goal of advancing both science and science literacy at the same time. You might have been encouraged to participate in this activity during the collections community's annual Worldwide Engagement for Digitizing Biocollections (WeDigBio) Event, which is a major data creation campaign. However, this lesson plan can be incorporated into the classroom in a meaningful and productive way throughout the year. For more information on the WeDigBio Event, including the dates of the next event, visit [wedigbio.org](http://wedigbio.org).

Several online platforms have been developed to engage participants in this activity, which is often referred to as "transcription." If you are teaching a class in Florida, we encourage you to look for a Florida-focused transcription project. An easy way to find one is to look for a WeDigFLPlants transcription project at Notes from Nature (<https://www.notesfromnature.org/active-expeditions/Herbarium>). However, there are other platforms that might provide projects of value to your educational objectives, including the Smithsonian Transcription Center, DigiVol, and others. WeDigFLPlants (<https://biospex.org/project/wedigflplants>) is a collaboration between collections curating Florida-collected plant specimens and naturalist groups in Florida, including the Florida Native Plant Society. The goal of WeDigFLPlants is to produce a complete historical baseline for understanding, conserving, and managing Florida's biota today and in the future.

This lesson integrates several components and is designed to provide students the independence to progress at their own speed. Instructors are encouraged to use this lesson as a complement to others on biodiversity, biodiversity research collections, data literacy, or another science topic. There are four resource types for the lesson: two videos available from the CPALMS

Educational Resource site; several websites, including Notes from Nature and the Atlas of Florida Plants; the instructions and Q&A's provided in this document; and a student worksheet.

### Procedure

- 1) Students watch the video "Library of Scientific Plant Samples: Step inside an Herbarium" (<http://www.cpalms.org/Public/PreviewResourcePerspectivesVideo/Preview/166547>) and answer questions in Part 1 of the worksheet while watching the video.
- 2) Discuss findings as a group:

Why are plant specimens an important resource for botanists?

*A: Plant specimens are samples of life as it existed in Florida or elsewhere in the past. Every herbarium specimen tells who collected that specimen, where it was collected, and when it was collected. But it also represents a sample that can be used for genetic, isotopic, disease-load, and other types of analyses today and in the future.*

How could this evidence be important to understand how ecosystems change over time?

*A: Landscapes can be altered by environmental factors (erosion, flood, fire, climate change, etc.) or direct human influences (construction, pollution, etc.). These records of the past allow us to reconstruct how Florida looked a hundred years ago to compare to today.*

- 3) Announce that you will show them a website where anyone can search for digital specimen records of interest. This is the iDigBio Portal, which provides access to >100 million records for plants, fossils, insects, birds, mammals, and many other types of specimens that have been collected from around the world. iDigBio is the US National Resource for Advancing Digitization of Biodiversity Collections. Visit <https://www.idigbio.org/portal/> and under Scientific Name enter "Pinus palustris". Hundreds of dots, each representing one or more specimens of Longleaf Pine, will appear on a map of the Southeastern United States.

Explain to the class how Longleaf Pine habitat was once the most common habitat type in the Southeastern United States Coastal Plain, but now Longleaf Pine is the dominant species in just over 3% of that original range due to logging, conversion of land to agriculture, fire suppression, and other activities.

How can data like this be used to affect change (e.g., create policy to conserve natural places)?

*A: Researchers and conservationist can marshal historical evidence to guide future management decisions. The hundreds of specimens represented on the map provide our understanding of the historical distribution of Longleaf Pine and can be used to guide our attempts to restore Longleaf Pine to its past range.*

If you were a botanist studying Longleaf Pine 25 years ago (before the availability of the digital, internet-deployed, data about the specimens), what strategy might you have used to find those hundreds of specimens?

*A: Prior to the creation and publishing of digital data about specimens, scientists would call or write to each herbarium to discover what specimens they contained for a species of interest. The scientist would then request a loan of those specimens from the herbarium for study. The loans would be held for months or years. Alternatively, scientists might travel to the herbarium to work as a visitor, like what you do when you visit a library. With digital data and publishers like iDigBio, many scientists can work with the specimen data and images at once and from anywhere with an internet connection. That's a clear advantage to having the data in digital form.*

- 4) Have students open two websites on their computers:

Notes from Nature: <https://www.notesfromnature.org/active-expeditions/Herbarium>

Atlas of Florida Plants: <http://florida.plantatlas.usf.edu/>

Explain that Notes from Nature is a transcription platform that allows anyone worldwide to participate in the creation of digital data for biodiversity research specimens.

Students will be entering label data from five herbarium specimens from one of the WeDigFLPlants expeditions and comparing the specimen locations to already available records for that species.

Enter label data from one specimen while they watch. Explain to them any part of the process that you believe they might have immediate questions about. The fields requested on Notes from Nature can vary from project to project, but an example of a field that might require clarification is "Location." For most current Notes from Nature projects, "Location" is the label content that would help a person relocate the population once they've arrived in the right county. So, county, state, and country should not be entered in "Location." You could choose to ask them to read through the tutorial and "Need some help with this task?" content the night before.

Do a search for the species on the specimen that you just worked through at USF's Atlas of Florida Plants. Show them where the county-level distribution map is for the species on the species page. They will do this as they create data at Notes from Nature.

*\*Optional\** There is an information icon under each specimen image in Notes from Nature that provides existing information about the specimens and customized links to online resources about the species documented by the specimen. Students can search for the existing specimen records for the species using the iDigBio link (not part of the exercise) or use this area to copy the scientific names to be used for the Atlas of Florida Plants search (rather than typing the name).

- 5) Have students complete Part 2 of the worksheet while they work and compare location information to what is already known about the species' distribution at Atlas of Florida Plants.
- 6) Discuss findings once completed:

Congratulations! You just contributed to science! Did anyone transcribe a specimen that was found in a county not previously recorded as part of the species' range in Atlas of Florida Plants?

*A: [If someone found one] You found a new county record! Your data will be used to produce a more complete picture of where to find that species.*

*[If none found] Did any of you notice distribution maps with all but one county of the panhandle or peninsula filled in? It's not necessarily the case that the species isn't in that county as well. In fact, it's not uncommon for previously "undigitized" specimens unknown to the Atlas of Florida Plants to be discovered. With each new digital record, we have the chance of building a more complete picture of where to find Florida plant species.*

Who found the oldest specimen? That specimen data has not been readily available for \_\_\_\_ years, but you just changed that! Although it may have been studied by botanists or others visiting the collection that curates it, its data are now readily available to anyone worldwide with an internet connection.

How have the methods of gathering the data on the label changed between then and now? And how might that lead to differences in the fitness of research use for that data? It is important to evaluate the data before using it for your research or other purposes.

*A: Specimen locations might have often been described less precisely (e.g., "about 5 miles south of Tallahassee") in the absence of GPS technology. This makes it more challenging to use older collections for some uses (e.g., producing a mathematical model of the habitat needs for the species) but not others (e.g., mapping the distribution of the species at the county-level—it's clearly collected somewhere in Leon County from that description).*

How might you or others use the type of data that you just created for personal enjoyment?

*A: There's a great diversity of personal uses for the data that you just created by hikers, nature photographers, native plant gardeners, genealogists, artists, and others. For example, a nature photographer might have the goal of photographing all of the sunflower species in their Florida county of residence, and they could use the collection location information to visit a population of each of them. Or a descendant of one of the specimen collectors might be trying to reconstruct their ancestor's collecting trips to Florida during the 1920's. Or a student might find the specimens to be useful as primary sources for their science fair project. You now know where to find this type of information at the iDigBio portal and the Atlas of Florida Plants website.*

- 7) Explain to students that what they just participated in is often called Citizen Science. Citizen Science projects broadly invite everyone to participate in the scientific process in authentic, valuable ways. Encourage the students to continue to participate in citizen science, either in this project or another. There are many online opportunities, such as others at Zooniverse (<https://www.zooniverse.org/>; Notes from Nature is a part of the Zooniverse), and field opportunities, such as those at the SciStarter directory (<https://scistarter.com/>).

## **Evaluation**

Evaluation can occur using their responses on the Worksheet and their participation in classroom discussion.

## **License and Acknowledgements**

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## HELP BEHIND-THE-SCENES AT A MUSEUM AS A CITIZEN SCIENTIST Worksheet

**Part 1:** Answer the following questions while watching the video “Library of Scientific Plant Samples: Step inside an Herbarium.”

What is an herbarium?

What is an herbarium specimen? How are they collected?

What information does an herbarium specimen contain?

Who uses herbarium specimens?

**Part 2:** Complete the following table while transcribing five plant specimen labels on Notes from Nature (<https://www.notesfromnature.org/active-expeditions/Herbarium>). While doing this, compare the information on the labels to data at the Atlas of Florida Plants (<http://florida.plantatlas.usf.edu/>). Use the Florida counties map on the next page to orient yourself as you look at the county-level map at AFP.

*Find the following answers using the herbarium specimen:*

	Specimen 1	Specimen 2	Specimen 3	Specimen 4	Specimen 5
What is the scientific name of the plant?					
In what county was the plant found?					
Is the county a known location at Atlas of Florida Plants?					
What year was the specimen collected?					

