

## Extra Credit: Herbaria and Digitization Due May 4 via Moodle for up to 15 pts extra credit

A more permanent way to archive plant records than iNaturalist or photographs is by collecting specimens to keep them in a herbarium. This is a permanent collection of pressed and dried plant specimens associated with descriptive labels explaining when they were collected, by whom, in what location, and additional information about the habitat, morphology, ecology, and sometimes human uses of the plants. Herbarium specimens and other natural history collections—bugs on pins, fish in jars, plants on sheets, fossils in trays, etc.—represent 3 billion data points that document the what, when, and where of the perhaps 9 million species on Earth. Each is a time capsule, a window to the morphological and genomic diversity for a species at a location at a particular moment in time stretching back several centuries for extant organisms and hundreds of millions of years for fossil organisms. By aggregating data from these specimens we bring into sharper focus historical changes to life on Earth with which to better predict future change.

In the last several years, herbaria and other natural history museums have made it a high priority to digitize and image their specimens, thus making them available for researchers and the general public. High resolution images of herbarium specimens can be linked to specimen databases and provide opportunities to study individual specimens without having to request slow and costly specimen loans, or a physical visit the museum. Large scale analysis of label data and determinations are a major source of “big data” for ecology and biodiversity studies, including tracking changes in phenology or species ranges in the 20<sup>th</sup> and 21<sup>st</sup> centuries, empirically inferring ecoregions boundaries based on species turnover, and analyzing variation in species morphology across time and space for taxonomic or ecological purposes.

One challenge to making use of this data is organizing and deciphering labels, particularly from older specimens in which the labels might be handwritten. Automated digitization and text parsing algorithms are still not sophisticated enough for accurately interpreting botanical labels. One excellent solution is to recruit citizen scientists to do this, and a variety of different web portals to aid in this digitization have emerged. One of these is “Notes from Nature” (Hill et al. 2012) which you will be using.



Figure 1. A herbarium specimen collected for research

## Introduction and Set-up

1. Watch this six-minute video about the herbarium at the New York Botanical garden:  
<https://www.youtube.com/watch?v=IK5Fdsr16Ps>
2. Which plant specimen, discussed in the video, was used as a fish poison? \_\_\_\_\_
3. Watch either of these other videos describing the herbaria at the Botanical Research Institute of Texas: <https://www.youtube.com/watch?v=WW2kX0Xz-CE> or the Arkansas Natural Heritage Commission: [https://www.youtube.com/watch?v=IlledM3\\_S1M](https://www.youtube.com/watch?v=IlledM3_S1M)
4. List two things you learned about herbaria that was not mentioned in the first video.
  - a.
  - b.
5. Now, you will have a chance to look at herbarium specimens from across Arkansas. Go to:  
<https://www.notesfromnature.org/active-expeditions/Herbarium>
6. Create an account by clicking “login” in the upper right corner, then “Create Account”. Write your username here: \_\_\_\_\_. This will be used for me to assess your work.
7. Exit out, then use your SAME username/login to log in to the BioSpex event:  
<https://biospex.org/events/b046bd9c-4e22-4e97-9990-7ea21c64b3c9/signup>  
**Note:** This step is crucial for saving a record of your progress so I can give you credit.
8. If you have already signed in and are returning to continue digitization, you can skip straight to this link: <https://biospex.org/projects/plants-of-arkansas-discovery-and-dissemination>

## Specimen Transcription

1. Go to <https://biospex.org/projects/plants-of-arkansas-discovery-and-dissemination> If you scroll down you will see a variety of different “Expeditions”, or projects to work on. For now, choose: **Herbarium Plants of Arkansas: skeletal records for our southernmost herbarium (Part 2)**
2. Follow the built-in tutorial. It may automatically appear in a pop-up window, or you may have to click the “Tutorial” button immediately underneath the image of the specimen.
3. Transcribe the label data for one specimen. Use the help links to be sure you are following the correct style. Your job is to transcribe the information, not correct it.
4. Transcribe **five** more specimens from this campaign. Write their species names below (remember the proper way to write scientific names!):
  - a.
  - b.
  - c.
  - d.
  - e.
5. Transcribe **10 more** specimens from this campaign, then answer the following questions:
  - a. In what ways were the specimen labels similar over the set of 15 that you have transcribed?
    - a.
    - b. In what ways might this similarity facilitate research?

- c. In what ways did the specimen labels vary over the set of 15? To what do you ascribe this variation?
  - d. What did you see on the specimen labels that you did not understand?
  - e. Provide one thing that you had expected to see on a specimen label that did not appear on them. Why might that bit of information be absent?
9. Return to the main menu and switch expeditions to “The Flora of Benton and Washington Counties (Part 3)” or “Plants of Northern Arkansas: Glade Quest”. Indicate your choice here:
10. Digitize **15 more labels** from a second campaign (total of 30). Note that if you choose one of the other expeditions, you may be asked to digitize slightly different information (Locality, GPS coordinates, and habitat). This time, mark the collection years for the specimens you are digitizing:

## TIMELINE TRACKER

Mark the collection years for each specimen you transcribe.

1900    1910    1920    1930    1940    1950    1960    1970    1980    1990    2000    2010    2020

		1917	1924		1939-1945	1953	1960	1969	1988	2001		
		Amundsen is first to reach South Pole	Hubble discovers Milky Way is one of many galaxies		World War II	Norgay and Hillary ascend Mount Everest	Piccard and Walsh reach bottom of Mariana Trench	Apollo 11 lands Armstrong and Aldrin on Moon	"Biodiversity" first appears in a publication	First draft of human genome		

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11. In what ways might the collection methods (e.g., the means of getting to a collection site or catching the specimen or assigning a latitude and longitude, etc.) have changed over the time span of your collections? How might this have affected the relative research value of the specimens collected in the earliest year vs. the latest year?
  
12. On your own, find a **scholarly** article that uses a herbarium, or data from herbarium specimens. One good way to search for a scholarly article is to use library databases: <https://hendrix.libguides.com/az.php?s=57817> . ArXiv and JSTOR are two good choices. Write the complete citation of the article below (author, title, year, journal, pages) and briefly describe how the specimens were used:
  
13. You are finished! On the back of this page, please write an additional 2-paragraph reflection on this activity that describes any observations you made not indicated above, as well as what you learned from this activity.