**Module 5 Instructional Plan**

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| **General Information**  |
| **Lesson Title:** How to Collect and Press Plants in the Field |
| **Overview:** This activity will guide students through the process of collecting fresh plant material that will be transformed into a permanent herbarium specimen. Students will make a specimen for the plant they chose to represent their family’s botanical history. Each student will use a field press to preserve the plant they collect and record field notes about the plant. This information will be used to prepare a permanent record label that will appear on the herbarium specimen.  |
| **Subject(s):** Biology, Botany |
| **Grade Level/Setting:**Grades 9 -12/Biology or Ecology Science Classroom and outdoor lab  |
| **Prerequisite Skills/Prior Knowledge:**Students should be familiar with basic terms associated with plants (roots, stems, leaves, reproductive organs, etc.).  |
| **Three Dimensions**  |
| **Disciplinary Core Ideas:**Life Sciences: LS2 - Ecosystems: Interactions, energy, and dynamicsLife Sciences: LS4 - Biological Evolution: Unity and Diversity |
| **Science & Engineering Practices:**Obtaining, Evaluating, and Communicating Information  |
| **Crosscutting Concepts:**Patterns |
| **Integration:**Students will apply their knowledge from the previous four modules to collect, press, and record field notes for their chosen plant. Each student will document information about their plant including its family, scientific name, physical features, habitat, and geographic location. Students will apply their knowledge from Module 4 to describe their plant’s characteristics, habitat, and distribution. They will prepare a herbarium specimen that documents their chosen plant and provides a summary of the plant's significance to their family. |
| **Standards and Objectives**  |
| **NGSS Performance Expectations** Not applicable |
| **Tennessee Science Standards** ECO.LS2.10- Plan and carry out an investigation measuring species diversity (richness and evenness) and density in a local ecosystem. |
| **Learning Objective(s):** **The learner will:**1. Create a high-quality, scientifically accurate specimen using recommended best-practices for plant pressing.
2. Collect and record necessary field information about the plant the student is collecting and its surroundings.

**Guiding Questions:** * What is the best way to collect and document living plants to preserve them permanently as an herbarium specimen?
* What are the attributes of a high-quality specimen?
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| **Materials /Resources** | **Technology** |
| * Plant pressing supplies including: trowel, clippers, newspaper, blotting paper, corrugated cardboard, plant press with straps, markers
* How to collect and press plants **(Video: How to Collect and Press Plants)**
* What makes a good herbarium specimen **(PowerPoint)**
* Warm/safe location to dry plant presses
* Vocabulary list **(Handout 5.1)**
* Specimen Diversity WebQuest **(Handout 5.2)**
* Herbarium Specimen Label Template **(Handout 5.3)**
* “Guide to plant collecting” for instructors or interested students **(Handout 5.4)**
* Herbarium Specimen Google Form
* Individual students’ live plant specimens (brought in from home)
 | * GPS unit or cell phone service with GPS location enabled on a digital device (phone, tablet, laptop etc.)
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| **Safety Concerns** |
| Appropriate safety precautions when taking students outdoors (e.g., avoiding dangerous plants, wildlife, staying with the group) and caution using sharp clipper blades when cutting plant material.  |
| **Academic Language** |
| **Vocabulary:**Terms related to plant collecting: plant press, blotters, newspaper, cardboard ventilators, straps, drying cabinet, upper and lower leaf surface, sterile, vegetative, reproductive, growth form, abundance |
| **Other Language Demands:**Syntax**:** taxonomy, binomial nomenclatureDiscourse**:** written field notes |

**5E Instructional Strategies and Learning Tasks**

**Engagement**

Students are shown a video (<https://www.youtube.com/watch?v=9oI-HAH4rj4&list=PLvzMzHvAgzWi_leFvfUMccUKaaopAJSXH&index=6>) where they learn to properly collect plants in the field and press them in preparation for the archival process. During the video, they should look for terms mentioned on **Handout 5.1** and try to answer the questions as well.

In addition, you may wish to share the **PowerPoint 5.1** “What Makes a Good herbarium Specimen” with the class prior to having them collect plants themselves.

**Exploration**

Prepare students to collect their plants. The students should bring in their plant of choice on the day you are prepared to press. If the student was not able to bring their specimen to class, they should have procured a backup plant to be pressed instead.

NOTE: Plant collecting is never permitted in national or state parks, natural areas, or nature reserves without prior permits. Teachers and students should choose areas such as roadsides, power line rights-of-way, or other areas where they have received explicit permission to collect.

Remind students of the information they need to collect when they are “in nature,” referring back to Handout 4.4 (Field Data Sheet) from Module 4. At the time of actual collection, they should reference this sheet, handout 5.3, and submit this data through a Google Form. We have a sample form available here: <https://forms.gle/sbe8jfmDDDtYQtQEA>. This data is then used to create pre-formatted specimen labels with Microsoft Mail Merge. You are welcome to use our form for student data entry; contact Shawn Krosnick (skrosnick@tntech.edu) if you would like us to generate the final labels for you as a PDF. You can then print them and cut them out for each student. The final specimen labels will be used in Module 6.

NOTE: If it is not possible to press the plant soon after collection (for example, if it was collected several days prior), specimens should be labeled and placed in a large white plastic garbage bag (13 gallons or larger) with a damp paper towel. The bag should be sealed and refrigerated (not frozen) until pressing. This method will preserve most materials quite well for 24-48 hours, except for delicate flowers. Extra flowers or other delicate materials can be preserved in smaller gallon-sized bags and kept separately refrigerated so they aren’t damaged in the larger bag.

Once specimens are placed in the press, the press should be moved to a warm, dry location to facilitate drying of the plants. One hundred degrees F is ideal, or the press can also be placed in a hot car for several days. The faster the specimens dry, the better their quality; however, safety is most important. Never place specimens in an oven or over an open flame.

**Explanation**

Questions/ideas to discuss after gathering plant specimens:

* Ask students to consider what they have learned in past modules about the most important plant structures to include on a specimen.
* Ask the students to imagine that a scientist is going to examine their specimen 50 years from now. What features of their specimen will the scientist find most interesting? What questions will the scientist use their specimen to answer?
* How do the students think colors on their specimens will change over time? Why might that happen?

**Elaboration**

Students will complete a WebQuest using the New York Botanical Garden’s C. V. Starr Virtual Herbarium to look at the diversity of plants preserved in herbaria. Specimen Diversity WebQuest handout 5.2

Students individually will go to this link <http://sweetgum.nybg.org/science/vh/> and answer the handout that corresponds.

**Evaluation**

Ask students to reflect on the following questions as an exit ticket or homework assignment:

* What unanticipated challenges did they face when collecting their plant?
* What are three interesting things they learned from the WebQuest.
* How does their specimen relate to the specimens in the WebQuest?