Herborizing plant diversity

GLOBE		Associated SDG	Type of Activity
Sphere	**Protocols**		
Biosphere	Land Cover Classification Biometry Green-Down Green-Up	15: Life on Land	Research

Overview

When you walk through a place, a great diversity of animals and plants can be found. In order to describe this diversity, there are several techniques. One of the best known is the collection of plant samples to preserve them in a herbarium and later determine their taxonomic classification. This activity presents a simple way to make a herbarium with the main plant species found in the study site selected by the students.

Time

50 minutes for species collection
10 minutes every other day to dry the plants.
100 minutes to set up the herbarium and determine species.

* The time may change depending on the number of species to be placed in the herbarium

Prerequisites

None

School level

All

Purpose

Students will collect plant species found around the school to create a herbarium and preserve a sample of the biodiversity around the school.

Student Outcomes

- Students will observe the variety of plants that exist in the environment
- Students will collect a sample of the plants found and preserve them for later determination
- Students will determine the genera and/or species to which the plant species found belong
- Students will create a herbarium with additional information that may be useful for further research

Background

The dictionary of the Royal Spanish Academy defines herborization as the process through which plants, leaves, fruits or seeds are sought and collected for later study (RAE, 2022). For this purpose, the collected plants must be properly dried and identified with their scientific name and common name. In addition to the name, it is important to record other information about the plants such as the place of collection, the date, the uses given and the name of the individual who made the collection. All species that have this information are placed in an orderly manner in a herbarium. In other words, a herbarium is a catalogue of the diversity of plants in a given place.

Determining the identity of collected plant samples is done on the basis of the characteristics of a group that shares a common ancestor. This group is called a taxon. The Table 1 shows how the taxonomy of the Kingdom Plantae or plant kingdom is organized, with its different groups and taxa.

Table 1
Taxonomy of the Kingdom Plantae

Taxon	Termination	Example
Kingdom		Plantae
Division	Phyta	Magnoliophyta
Class	Opsida	Magnoliopsida
Order	Ales	Magnoliales
Family	Aceae	Magnoliaceae
Genre	Always in *italics*	*Magnolia*
Species	Always in *italics*	*Magnolia grandiflora*

When a plant is found and its identity is not known, what is done is to determine it. Determination is the scientific process through which we come to know the scientific name of a species unknown to us but which was studied by taxonomists at some point in the past. Often times this term is confused with classification, which is the process through which a plant is placed in a certain taxon based on common characteristics. Classification is only done once for those species that are new to science, whereas determination is something that is done many times when researchers encounter species that they personally do not know. In order to determine the identity of a species, scientists use dichotomous keys (Alvaro-Alba, 2006) or images from other herbaria to compare the species found.

Through this activity, students will learn and practice plant collection and conservation techniques. At the same time, they will recognize the diversity of plants in their study site, thus improving their appreciation of the ecosystem around them.

Guiding Research Questions

- How many plant species are there in the school?
- What are the most common plants in the school?
- How can a plant sample be preserved?
- How does the name of a plant get to be known?

Materials and Tools

- A wooden press
- Cardboard, old newspapers and paper towels
- Jute cord or thick thread
- A pair of scissors
- A pencil
- Sheets of paper
- A needle
- Thread
- Cardboard paper
- Local plant guides

What to Do and How to Do It

- ***Beginning***
  - Teachers take their students out into the field and ask them to walk around the space and look carefully at the plants around them.
  - Then, the teachers ask their students if they recognise all the species. They will probably say no and this will lead the teachers to explain that it is important to have a collection of plant samples where the diversity found in that place is appreciated.

- ***Development***
  - The students will put together a herbarium and the first step will be for the teachers to explain to their students how to make a good collection of plants. To do this, the following should be taken into account:
    - To take old newspaper sheets and scissors to the field
    - To take a sample from the plants. They need to make sure to collect a sample that is as complete as possible. This should have leaves arranged along a branch and, if possible, keeping the flower, as for many species the flower is key to determining species (Figure 1)
    - It is recommended to make the cut with scissors and diagonally so that the plant heals the stem as well as possible. It is recommended to include the flower and fruit (if any, in the sample).
    - All collected samples should be placed between newspaper sheets for pressing later on.
    - For determination purposes, it helps a lot to take pictures of the whole plant and the environment where it grows.
    - Always remember to take a small notebook and a pencil to the field to record some data about the species collected and to establish a code to relate the sample with the environment where the plant was collected.

Figure 1: Herbarium plant sample
Source: Brazil REDFLORA

- Once the plants have been collected, the next step is to press the samples. For this it is recommended to use a wooden press. The press can be made with wood that comes in fruit crates, nailing the pieces of wood together, forming a grid and placing two sheets of cardboard inside them (Figure 2). Often times, when a wooden press is not available, thick books can be used instead.

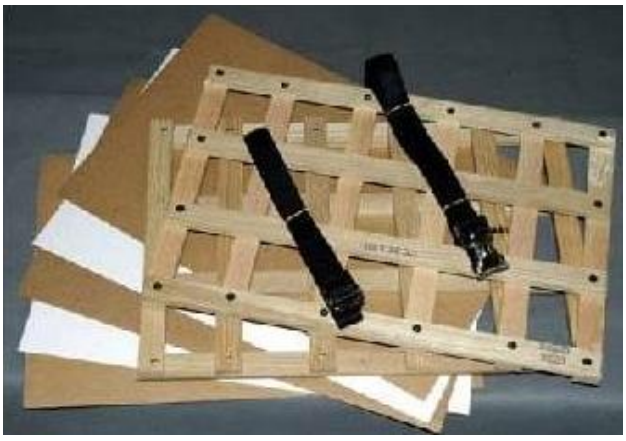

Figure 2: Wooden press for drying plants. These are usually 30 cm wide and 45 cm high.

- Next, the sheets of newspaper with the collected samples are placed inside the press and with the help of a rope, they are tied to the press to ensure that they will dry properly. This press can be placed on a heater (if available) or simply placed in the sun.

- Before tying the press, it should be checked that the plants inside the newspaper sheets are in good condition. The leaves should not be wrinkled and the flowers should be kept in paper towels to prevent them from being damaged.

- The paper should be changed every day or maximum every other day until the plants are dry.

- Once the plant samples are dry, they are removed from the press and sewn with needle and thread to a sheet of cardboard 30 cm wide and 45 cm high. For sewing it is important to secure the stems and branches. The leaves can be fastened with small strips of paper with rubber bands at the ends. Often times fishing line is used for sewing so that it is invisible. The plants are never glued directly onto the cardboard paper, as it is important that the plant can be given the opportunity to be replaced if the cardboard becomes damaged (Figure 3).

- Once the sample has been affixed to the cardboard, a determination label is attached. The label should contain basic information such as the scientific name of the plant, the name of the person who made the collection, the date, and some other information shown in Figure 4. To determine the species of the plant, botanical books, dichotomous keys, virtual herbaria, cell phone applications, or consultation with an expert can be used. Some suggestions for determination are given in the Resources section.

- Drawings made by the students can also be included in the herbarium to help them become familiar with the characteristics of the plants. This would be an activity that can be linked to art classes.

Figure 3 A sheet containing a plant sample, showing that the plants are attached by small strips of paper. At the bottom right is the label and to the left is usually an envelope with the florers placed inside.

Figure 4 Herbarium label

- ***Closing***
    - When finished, students place all the plant sheets in an album and make sure to keep it in a dry place, out of reach of moths.
    - Finally, the teachers give their students pieces of paper in the shape of leaves and ask them to write down what they liked best about making a herbarium. They might also ask them to write the name of their favorite plant species on the leaves.
    - The leaves written by the students are displayed as tree branches in the classroom. This will be the plant knowledge tree. Each time the students learn something new about plants, they can place new leaves on the tree.

Frequently Asked Questions

What happens if the plants are filled with fungus?
Change the leaves more frequently to prevent fungus. It helps a lot to place the press in the sun.

Could we complement the herbarium activity with the MUC Cover Classification protocol to describe the context in which the plant grows?
Please, do this! It would be a great activity and would help students understand the context in which plants develop.

Resources

Applications to determine plants***:***

- PlanNet: PlantNet Plant Identification - Apps on Google ***Play***
- iNaturalist: iNaturalist
- Google lens: Google Lens: Find what you see

Guides for making a herbarium:

- Manual of Curation and Preservation Techniques for a Weed Herbarium https://bit.ly/3eDYe7A
- Developing a Local Herbarium: A Basic Guide https://bit.ly/3BDpeNX

Dichotomous keys:

- Dichotomous keys for common ornamental species https://bit.ly/3ewxhCN
- Dichotomous key containing information about plants for primary https://bit.ly/3RT9uM0

Virtual herbarium:

- Herbarium of the National Autonomous University of Mexico. https://bit.ly/3cWHA2V
- Herbarium of the National Commission for the Knowledge and Use of Biodiversity https://bit.ly/3DhHXj5
- Herbarium of the Missouri Botanical Garden https://bit.ly/3TZPuco
- REDFLORA Herbarium - Brazil https://bit.ly/3xdxYaC

Bibliography

Alvaro-Alba, W.R. 2006. Key to genera and some species of ornamental plants of Tunja (Boyacá - Colombia) Science in Development (2) 2: 39-59 ISSN 0121-7488

RAE - Royal Spanish Academy. 2022. Dictionary of the Spanish language, 23rd ed., [version 23.5 online]. Retrieved from https://dle.rae.es