Seasons in the life of a Tree

Minimum Time Required

Approximately 40 mins required to introduce the unit and for task 1 and task 2.
10 mins per week for observation & recording observations in the ledge

Type of learning unit: Outdoor activity

How to conduct Unit

i. For this learning unit teacher will conduct first two tasks (help in identifying and predicting /hypothesizing about the seasonal changes expected in the tree). Students should be able to justify their predictions, though it may be proved wrong based on observed data.
ii. Teacher can conduct discussion session of half an hour in every three months
iii. In these discussion sessions teachers can ask students to present their data

Links to Curriculum

There are sporadic references to Trees and topics relevant to understanding of a Tree across the NCERT science curriculum from class 6 to 9.

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Learning objectives

i. Observing the behavior (flowering, fruiting, leaf-shedding, sprouting new leaves etc) in a tree over the seasons (Task 1 and Task 2)
ii. Recording (and Reporting) the observed data (Task 3)
iii. Contributing to an active scientific process (by discussing the reported data with others through Vigyan Pratibha web site - Discussion Forum)
iv. Collaborative science: looking at and commenting on data from other Vigyan Pratibha groups

Expected Successful outcomes

1. Engage with flora in the immediate surrounding
2. Being more attentive to nature around ourselves and thus become sensitive to our surroundings and phenomena
3. Understanding the importance of regular, and detailed data collection.

Novelty of learning unit

i. Students will start to recognize and study biology around them
ii. Data will be varied depending on students surroundings; compiled data will make Biodiversity evident.
iii. National scale data collection drive initiated through this.
iv. Most importantly, students will contribute real, collaborative science and scientific research and will be part of national level scientific research program.

Introduction

Discovering something new about nature is not an easy task. It cannot be done casually. It requires a lot of observations from different locations/ places for a longer period of time to predict something about nature. Does the scientist do it all alone? No. For such observations scientists and sometimes, people across the globe come together and share their observations with each other. It avails large amount of data from different places, in large span of time.

As we know, we depend on trees in various ways to fulfill our needs. We always read about trees in books/ on the internet, but we ever tried to see how they get affected by changes in seasons?

Trees go through various seasonal changes. Which may directly or indirectly affects the health of a tree or may cause morphological changes. For example - in summer, some trees shed their leaves completely, while some tree starts flowering or fruiting. These changes may vary in different trees.

In this **Activity**, we are going to record how a tree of the school campus/neighbourhood shows changes **in different periods of the year!** It requires students to:

1. **Spot a tree in the school campus or in close neighbourhood** which flowers/fruits seasonally (so, Coconut tree and most of the palm trees are out!)
2. Identify it by the **common name, local name and botanical name** (if possible).
3. Oserve the tree in their school campus and record major features like flowering, fruiting, leaf shedding/sprouting etc.
4. Plot graph of these changes against time.

Materials required

1. Identifying at least one tree of the school campus or neighbourhood
2. Pen & paper
3. Ledger/notebook (1 per tree)
4. Data and photo uploading facility- directly through the Vigyan Pratibha website, Whatsapp, E-mail etc (Optional)

Task 1: Identify your tree

Choose any tree on your school campus/ immediate neighborhood. Choose a tree that you think **flowers/ fruits seasonally** and answer the following:

Q.1. What is the local name of your tree?

_____

Q.2. Can you guess how this local name arrived for the tree?

_____

The local name of a tree may differ from region to region. Also that name may arrive because of different use of plant part or any other reasons.

Q.3. Can you see any flowers on your tree? Describe briefly.

Q.4. Does your tree have any fruits? Describe briefly.

Q.5. Trace the outline of a leaf/ Draw the structure of a leaf.

Q.6. Is there any insect, ants, beetles etc. on your tree?

Q.7. Is there any animal (e;g; birds, insects) near your tree?

Q.8. If yes, what did these animals receive from your tree?

Task 2: Predicting/Hypothesis-building based on the chosen tree

> In this task, students will answer the questions based on their previous knowledge/ observations. As the answers will be based on students' observations, it is not necessary to get similar answers as given in the textbooks or any other resources.

In this task we will predict what changes will occur at a particular month in a tree by answering the following questions.

Q.1. Does the tree have any seasonal flowering pattern?

Q.2. In which month/ months your tree will be flowering ?

Q.3. In which month/ months your tree will be fruiting ?

Q.4. Does your tree sheds its leaves in a year? When ?

_____

Q.5. Does you tree sprout new leaves? When?

_____

Based on your answers let us make a line-graph that can show changes occur in a tree with respect to months.

Task 3: Observation of tree for every week

i. Observe the tree for 10 mins every week.
ii. The Observation datasheet is provided for initial stage of observations is as follows:

Latitude & longitude of your school:_____

Month & Year: _____ Date: _____

Temperature (Maximum & Minimum):_____Time: _____

Relative Humidity: _____ Season: _____

Sr. No.	**Morphology**	**Detailed Description (Name of insect/ animal)**	**Observations**		
			Many	**Few**	**None**
1	Flowering				
2	Fruiting				
3	Presence of New Leaves				
4	Presence of mature leaves				
5	Branches without leaves				
5	Presence of birds				
6	Presence of birds nest				
7	Presence of any animal around tree				
8	Presence of any insects near your tree				
9	Any other observations				

(If more than 1/3rd of the branches of the tree have even one fresh leaf each, then it is approximated as 'many'. If equal to or less than 1/3rd of the branches have even one fresh leaf each, then it is classified as 'few'. This same logic is applied to flowers and fruits as well.
During holidays students can coordinate with caretakers of schools to observe the tree. The teacher-coordinators in schools need to come up with creative methods to ensure this happens. If it is absolutely impossible to monitor your trees during holidays, then don't worry: it's better to have the information from the rest of the year than to have no information at all)

You can make your own datasheet for observations.

Task 4: Representation of Collected Data and share/ compare it with others

i. Students can represent their data after every three months using line chart.
ii. Students can share their data with other groups and find the differences.

If the data of different tree species shows different patterns, then the teacher can engage students in a discussion why such patterns occurs if

- both the tree species are in the same season and get same sunlight?
- both the species are located in the same geographic location?

Expectation from students from various backgrounds

1. Students learn the life in the year of the ONE tree they choose
2. A data depository at each school, maintained in school by students over the years -- tree notebooks/ledgers can be updated yearly.
3. Students who follow multiple trees can start looking at variation in biodiversity
4. Students who access data from other schools for the same or different species and look at flowering/shedding/fruiting/seeding trends can start to look at biogeography.

Extensions of the activity

These tasks can be performed in a groups.

Task 5: Calculate canopy cover

- Imagine the canopy of a tree is in a circle with a stem of tree as a center of circle.
- Walk from the center to 8 different directions to get a radius while looking up to the canopy.

Note: Make sure that when you walk in 8 different directions such that it will cut the circle into 8 equal pieces.

- Mark those spots and record the radius. (You might not get the same radius from all directions.)
- Calculate the area of each sector by using the following formula

$$Tree\ Canopy\ Cover = \frac{45°}{360°}\pi \times r^2$$

(If we consider that we cut the circle into 8 equal halves then each sector will have an angle of $45°$.)

- Add the area of each sector to get the total canopy cover.

Task 6: Measure the tree height using Hypsometer

In this task, students can measure the tree height using the 'Hypsometer'. An instrument used to measure the height of an object using similar triangle theorem or by using trigonometry.

Task 6.1: Measure the tree height using Hypsometer model 1

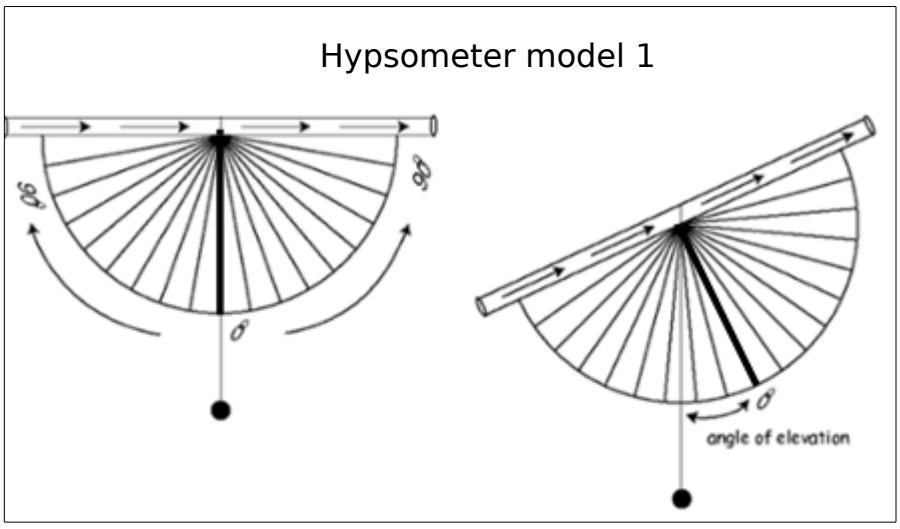
Materials required

For each group:

- 1 clear plastic protractor, with a hole in the center
- 1 piece of thin string, approximately twelve inches in length (make sure the string is thin enough to easily fit through the center hole in your protractor)
- 1 or 2 washers or other heavy object
- 1 straw approximately nine inches long (the larger its diameter, the easier it will be to use; the smaller the diameter the more accurate your results will be)
- Adhesive tape

How to make hypsometer model 1

- Loop the string through the center hole in the protractor and through the hole in the washer(s). Tie the string securely leaving it long enough so that when you hold the protractor with the ruler side up, the weight hangs suspended below the curved arc and the string intersects the numbers that indicate the angle being measured.
- Use adhesive tape to affix the straw along the straight edge so that the protractor hangs below the center of the straw's tube. Do not tape the protractor to the side of the straw, and be careful to apply the tape where it will not impede the motion of the string.



To measure the height of a tree

- Hold the hypsometer parallel to the ground such that the string will be perpendicular to the hollow tube.
- Now looking through the hollow tube, observe the top of a tree whose height to estimate.
- Observe the top of a tree in such a way that the angle of elevation will be 45 degrees (From the eye to the tree top)
- Measure the distance from tree to your position.
- Add the measure of your height to get the total height of a tree.

Task 6.2: Measuring tree height using Hypsometer model 2

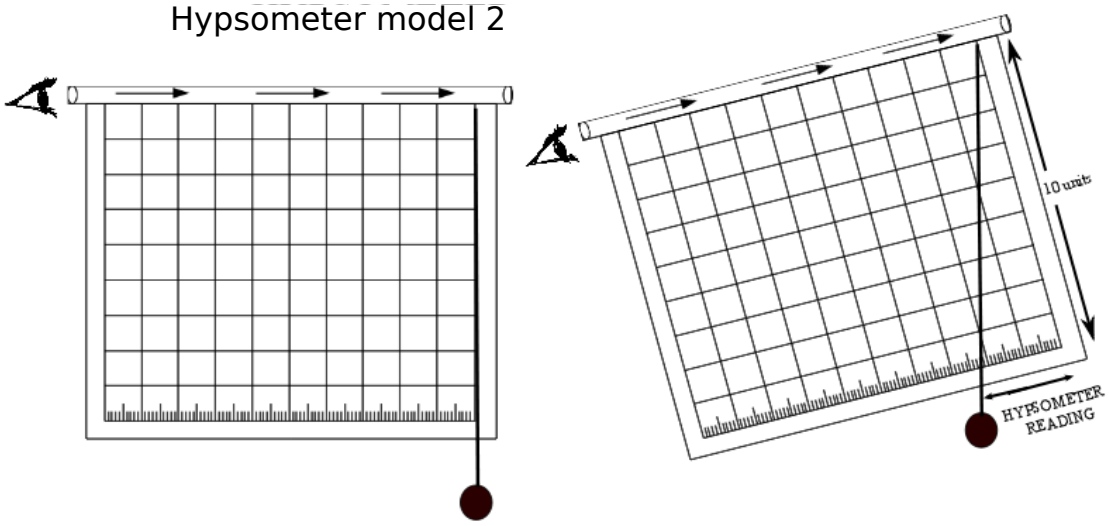
Materials required:

For each group:1 Graph paper, 1 cardboard, 1 plastic straw/ hollow tube, 1/2 washers or heavy objects, string

How to make Hypsometer model 2

- Take 2 cm scale as 1 unit up to 10 units on both axis of a graph paper.
- Mark point A on the 10th unit of Y axis.
- Cut the cardboard into a rectangle of 10 inches *11 inches
- Glue a sheet of grid paper on stiff cardboard. Next, tape a plastic straw along the upper edge of the cardboard and grid paper as shown in the illustration. Make a hole on point A.
- Then hang a weight/washer on a piece of string from point A. We are now ready to measure the height of objects.

Hypsometer model 2



To measure the height of a tree

- Stand at a distance from tree and measure it.
- Now hold the hypsometer and sight through the straw/ hollow tube such that the weighted string hangs perpendicular to the tube.
- Then carefully tilt the device until you can see the top of the tree and clamp the string with your finger. (Or you can ask your friend to note the reading where the string crosses the bottom line of the grid drawn on the cardboard.)

$$Height\ of\ Tree = \frac{Hypsometer\ reading \times Distance\ between\ the\ tree \wedge an\ observer}{10}$$

- The obtained height of a tree is from above the height of an observer. So to get the total height of a tree from the ground level, we have to add an observer's height into the answer.

Total height of a tree= Height of an observer + height of a tree

References

I. Season watch: https://www.seasonwatch.in
II. HBCSE Mathematics lab: http://mathedu.hbcse.tifr.res.in/mathematics-laboratory/