

SUSTAINABILITY & BIODIVERSITY

An activity-based learning
program for schools



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THIS BOOKLET CONTAINS:

- All information and instructions required to carry out the activities.
- Worksheets that can be photocopied and used for data collection in the field. These worksheets are provided as an example and you are welcome to use other formats of your choice for the same. But be sure to collect all relevant information as required for each activity.

THE ACCOMPANYING RESOURCE MATERIAL CONTAINS:

- Printed sheets to make game cards and jigsaw puzzle pieces.
- *Plants around us* : A set of posters on three common plants - the Giant Milkweed, Singapore Cherry and Neem by Nature Classrooms
- *Hidden Housemates* : A set of 'Bingo' activity sheets to discover, observe and engage with biodiversity that lives in our homes, balconies, gardens by Nature Classrooms.
(Source: www.natureclassrooms.org)

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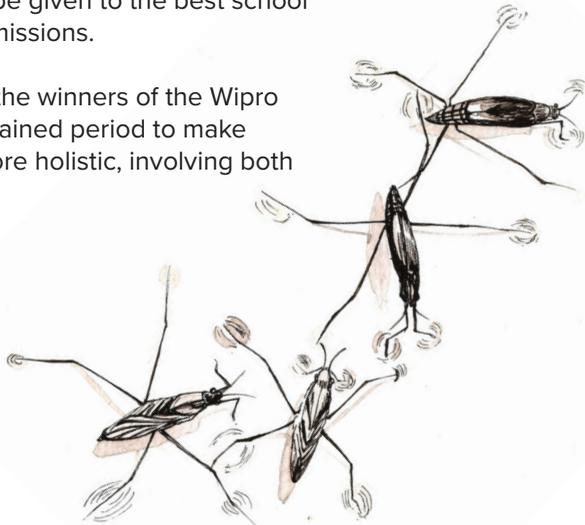
The diversity of life forms,
so numerous that we have yet to
identify most of them,
is the greatest wonder of this planet.
– Edward O. Wilson, *Biodiversity*, 1988

INTRODUCTION

Earthian is Wipro's Sustainability Education Program for schools and colleges. The program helps students develop an interdisciplinary understanding of the topic at hand and provides multiple perspectives to help make sustainability education more meaningful. By meeting these objectives, educational institutions, their educators and students will be better equipped to make sustainable choices.

We invite you to form student teams and participate in this learning program on the theme of **"Biodiversity"**. Wipro Earthian Award will be given to the best school teams, based on your submissions.

We intend to engage with the winners of the Wipro Earthian Award over a sustained period to make sustainability education more holistic, involving both teachers and students.



WHY BIODIVERSITY



Look around inside your house. Who do you share the house with? Your family members, your pets (if any), plants, house geckos on the wall, mosquitoes, silverfish in the books, fruit flies hovering around the fruits, ants crawling...What kind of conversations do you hear? People speaking, crows calling, house geckos clicking.

Take a walk around your neighbourhood. What other life forms do you notice? More people, dogs on the street, trees, shrubs and climbers; if you look up and pay attention you will spot some birds; if you watch a plant up close you will find insects and spiders; if you dig the soil, you may find earthworms and other smaller organisms.

Wherever we go we observe living things.

➔ **Biodiversity** is all these things: it is **LIFE**.

CHARACTERISTICS OF LIFE:

- *Living things are made up of one or more cells.*
- *Living things interact with their environment.*
- *Living things metabolize matter and energy.*
- *Living things grow and develop.*
- *Living things reproduce themselves.*
- *Living things are adapted to their surroundings.*

Biodiversity is a combination of the terms 'biological' and 'diversity'. **Scientists use the term "biodiversity" to describe the connections and variety of living things in a given area.**

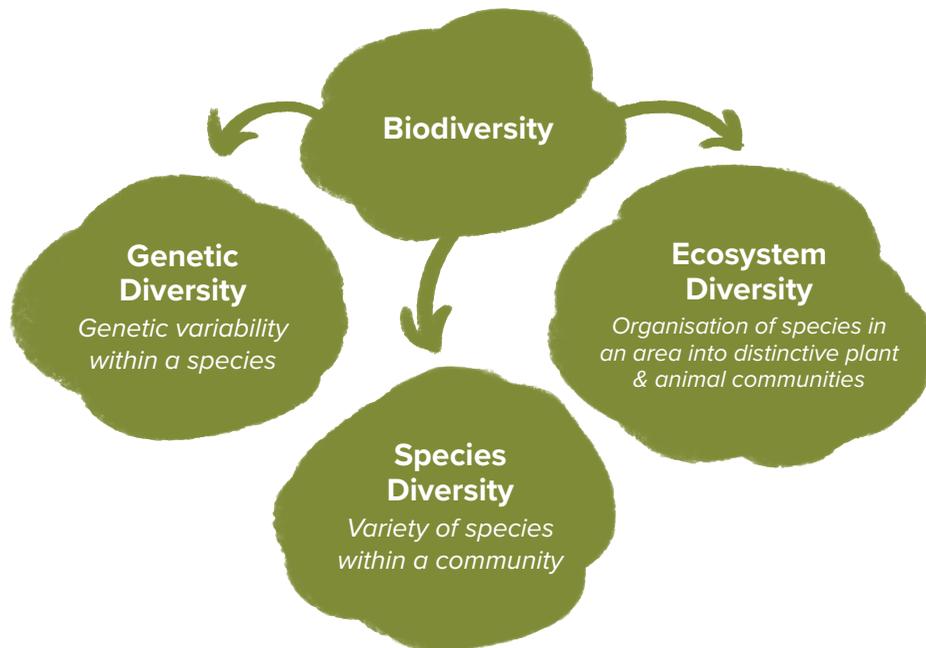
This area can be as small as a puddle of water or as big as the whole Earth. A healthy, complex, and stable ecosystem has a lot of different kinds of organisms.

One of the most important things to keep in mind about biodiversity is that it is not just plants and animals, but the connection between all the living things on the planet. This connection is important to all of us, because it provides us with a lot of resources and services that we need to live and thrive on this planet.

Pick an object. Think about what raw materials have been used to make the object. Where are these raw materials sourced from?

COMPONENTS OF BIODIVERSITY

Living things collaborate and compete with one another to stay alive and reproduce in a wide range of environmental conditions. This has led to an incredible diversity of life on Earth. Biodiversity can be defined in various ways - from genetic similarities, to specific classifications, to global habitats. It can include organisms from the largest whales to the smallest microbes.



A) GENETIC DIVERSITY



In the image we see a set of puppies. Though they all belong to the same species *Canis familiaris*, each one has its own unique set of physical traits, such as body shape and colour. These traits are caused by a set of genes that are unique to each animal, which makes them look different from each other. Remember that even though they all have genes that make them different, they also share genes that make them very similar.

Each member of any animal or plant species differs widely from other individuals in its genetic makeup because of the large number of combinations possible in the genes that give every individual specific characteristics. Tiger, lions and leopards are different species, with distinct genetic makeup. But even within a species, individuals are different from each other (to a lesser degree), such that each of us is unique! Diversity within a species enables individuals to adapt to their environment.

Think of other examples of genetic diversity.



B) SPECIES DIVERSITY



Bracket Fungi



Malabar Pit Viper



Bonnet Macaque

Photos: Abhisheka K

The images are of three living things that are distinct from each other. They have their own unique set of physical traits, such as shape, size, and structure. Here living things are not classified by genes but into small biological units called “species”. The number of species of plants and animals that are present in a region represents the area’s species diversity.

→ *A species is defined as a group of organisms capable of interbreeding and producing fertile offspring.*

C) ECOSYSTEM DIVERSITY



Photos: Abhisheka K

Riverine



Grassland



Mountain

Here we see three completely different types of ecosystems. Each ecosystem is physically different and is composed of a diverse set of biotic (living or once-living) factors such as birds, ants, trees and abiotic (non-living) factors such as air, water, and soil. Ecosystems need not always be on a large scale. A pool of water complete with organisms that can sustain themselves is a tiny ecosystem.

A healthy ecosystem is made up of a complex web of contributions made by a wide range of organisms. Plants, for example, provide food for humans and help make our atmosphere’s gas mix, which is important for all life on Earth. Animals die, decompose, and give plants the materials they need to grow. Bacteria help plants stay healthy by recycling nutrients that help them grow.

→ *The interrelationship of both biotic and abiotic factors determines an ecosystem.*

What kind/s of ecosystem does your schoolyard have?

India is exceptionally rich in its ecosystem diversity. Distinctive ecosystems are made up of landscapes such as tropical forests, dry-deciduous forests, grasslands, deserts, mountains, etc., as well as aquatic ecosystems such as rivers, lakes, and a number of marine ecosystems. They also include areas that have been modified by humans, like farmland and cities.

WHY DOES BIODIVERSITY MATTER?

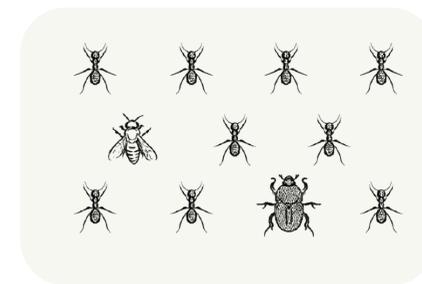
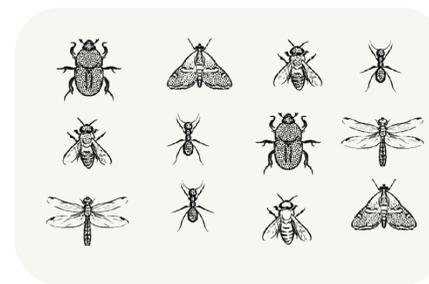
Which of these habitats do you like? Think of why you like or dislike a particular habitat shown here.



Photos: Abhisheka K

A habitat is a home environment for plants and animals or other organisms. A microhabitat is a small area which differs from the surrounding habitat. Its unique conditions may be home to unique species that may not be found in the larger region.

Which community below is more diverse? Which of these communities do you prefer to be part of?



All living things that come together in one place make up a community. Your school is a community of teachers, students, and other members who support each other. It is also a community of plants and animals where the plants and animals (community members) depend on each other to survive.

Biodiversity is not distributed evenly on Earth. Plant and animal diversity depends on climate, altitude, soils and the presence of other species.

- The more diverse an ecosystem is, the better equipped it is to deal with change. If a species dies out, or a new one moves in, a diverse ecosystem will be able to maintain balance.
- Genetically diverse populations are more likely to survive and adapt to changing environments.
- If biodiversity is low, ecosystems are less likely to bounce back from devastating changes, such as natural disasters like drought, floods and diseases.

Ecosystems such as cold deserts or snow-capped mountains in the Himalayan region may not be rich in species diversity compared to a forest ecosystem in the Western Ghats in Southern India. A coastline exposed to high waves will have considerably different level of species diversity compared to the mangroves. Similarly, an exposed hill or mountain top is likely to have stunted vegetation and low species diversity compared to more abundant vegetation and high species diversity in valleys that are sheltered from heavy wind.

Natural ecosystems with low species diversity are as important as ecosystems with high species diversity, because they consist of species that have remarkable specializations for surviving in harsh environments. Many rare and special varieties of plants and animals are found in such ecosystems.

THE HUMAN IMPACT

The diversity of life at all three organisational levels, genetic, species and ecosystem, is being rapidly modified by modern humans. Humans often try to reduce diversity because it is easier to harvest (whether it is food crops or trees for timber) if it all contains the same species, but this obviously creates serious problems.



Monoculture is growing of one species of organism such as paddy or wheat, eucalyptus or pine plantation, etc. Because all of the individuals belong to the same species, there are few complex food webs and disease can spread quickly.

INDIA - A MEGADIVERSE NATION

Megadiverse country is used to refer to the world's top biodiversity-rich countries that harbor high numbers of endemic species. To qualify as a megadiverse country, a country must

- Have at least 5000 of the world's plants as endemics (being unique to a particular geographic location).
- Have marine ecosystems within its borders.

Seventeen countries have been identified as the world's 'megadiverse' countries and India is one of them. India is home to nearly 8% of the global biodiversity. It is estimated that 18% of Indian plants are endemic to the country and found nowhere else in the world. Isn't this a matter of pride?

WOW! FACT

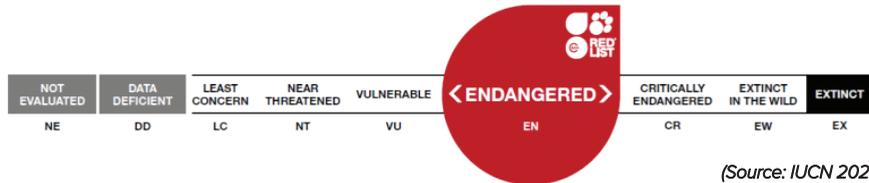
Biodiversity Hotspot

There are places on Earth that are both biologically rich and deeply threatened. These are 'hotspots' of diversity, the richest and most important ecosystems in the world. Amongst the 36 biodiversity hotspots in the world, India represents four of these hotspots

- The Himalayas
- Western Ghats
- The Indo-Burma region (consists of northeast India south of Brahmaputra)
- Sundaland (includes Nicobar Islands)



The IUCN* Red list of Threatened Species is a scientific tool for informing and guiding biodiversity conservation action. It is not just a list, but a compilation of information relevant to the conservation of species based on the best scientific information available.



(Source: IUCN 2022)

In descending order of threat, the IUCN Red List threat categories are as follows:

- Extinct or Extinct in the Wild
- Critically Endangered, Endangered and Vulnerable: species threatened with global extinction.
- Near Threatened: species close to the threatened thresholds or that would be threatened without ongoing conservation measures.
- Least Concern: species evaluated with a lower risk of extinction.
- Data Deficient: no assessment because of insufficient data.

BIODIVERSITY IS ESSENTIAL FOR SUSTAINABLE DEVELOPMENT

The 2030 Agenda for Sustainable Development, agreed by the 193 States Members of the United Nations, provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. At its heart are the 17 Sustainable Development Goals (SDGs), which are an urgent call for action by all countries - developed and developing - in a global partnership. Biodiversity and ecosystems feature prominently across many of the Sustainable Development Goals (SDGs) and associated targets.

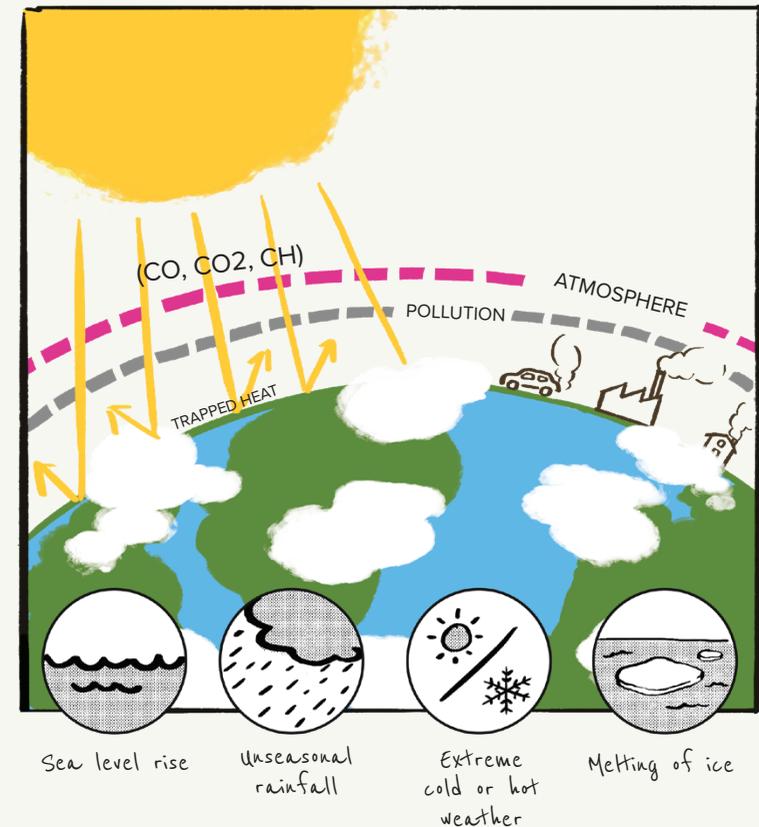
Source: www.sdg.un.org/goals



THE COLD HARD FACTS OF CLIMATE CHANGE!

The Earth has a natural process of warming itself by atmospheric gases called greenhouses (GHG) such as Carbon monoxide (CO), Carbon dioxide (CO₂) and Methane (CH). However, the balance of GHG in the atmosphere is being disrupted by additional GHG emitted due to human activity, causing warmer temperatures that has led to a change in climate.

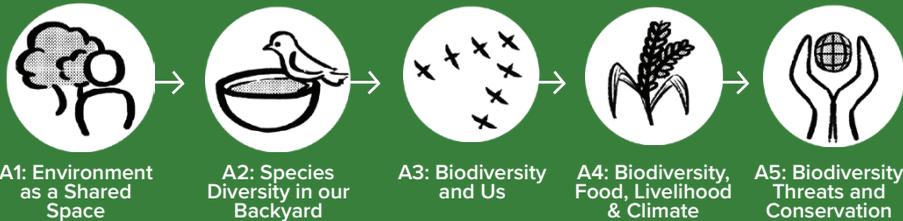
A warmer Earth is leading to a rise in sea level, changes in weather patterns, and disruptions to the lives of all living creatures.



STRUCTURE OF THE BOOKLET

PART A

Compulsory Activities



Elective Activities



PART B

Compulsory Activities



STRUCTURE OF THE ACTIVITIES

All activities have 4 components:

 **OBJECTIVES** tell you why you are doing an activity and what might be learned from it

 **INSTRUCTIONS** tell you how to do the activity

 **RESOURCES** provide you with tips and assistance to help carry out the activity. The formats shown under resources are optional. You are welcome to present the information in a style of your choice, but observations and data need to be recorded.

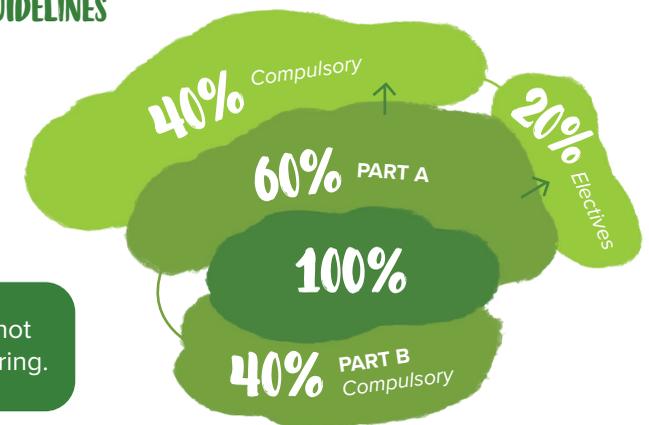
 **REFLECTION** is an important part of the learning experience. Use the questions to discuss, connect with, and explore issues beyond your immediate environment. You can also use the leading questions to

- Ponder on the observations and data collected during the activity.
- Discuss with people from a wide range of backgrounds such as teachers, classmates, scientists, writers, naturalists, historians, forest officers, parents and grandparents, and experts from universities and Government institutions.

PARTICIPATION GUIDELINES

SCORING PARAMETERS

Part A totals to 60% and Part B to 40%



*Fun activities are not considered for scoring.

EVALUATION OF SUBMISSIONS

The submissions to Wipro earthian will be judged based on a broad approach as deemed appropriate by the jury. It will be based on how genuinely the activity was done, the comprehensiveness and creativity in documenting the activities, and the ability in seeing and drawing the broader connections well.

To give you a sense of direction and clarity we are listing a few key evaluation criteria. Do not blindly go by these alone and pay attention to the broader approach as mentioned above.

- Genuineness in doing the activity as displayed in the details in the documentation: observations recorded, the data provided and other evidence of having done the activity.
- Creativity in documentation. Usage of multiple formats and ways and methods of reporting that are woven together well into a whole. See the following page (specific pointers for Part A & B) where some ideas for documentation are given.
- Beyond just the data presented, a sense of having understood the problems well, as displayed in the documentation.
- How well the activities done have been connected to each other.
- How well the connections to other issues have been drawn to expand the understanding of sustainability.

While the internet may be used for research, text and diagrams downloaded should not be included unaltered in the submissions. Such materials should be presented in the students' own words and sketches redrawn by them. Citations and references to books, interviews etc can be provided wherever required. It is the quality of the learning and not quantity that is important.

SPECIFIC POINTERS FOR PART A

Part A can be made attractive, fun and engaging by using different tools or presentation formats.

-  Present observations, data and your experiences during the activity as a narrative.
-  Observations can be presented as short poems, couplets, or haikus.
-  Illustrate with sketches, paintings and cartoons to highlight something visually interesting.
-  Take photographs and use them in the summary at appropriate points. Record videos wherever necessary and submit.
-  Use data charts / graphs and other such visuals to present the data attractively.
-  Any other creative / innovative method of presenting the summary as you choose.

You are required to complete 2 of the 4 electives described under the 'Part A Electives', whereas all the five activities under 'Part A Compulsory' need to be completed.

SPECIFIC POINTERS FOR PART B

Part B requires a different approach from Part A. The purpose of part B is to connect what you learn about biodiversity in Part A to the local context and to other domains.

Part B should be submitted in the form of a report (refer to page 17) within which you should include the Timeline, Seasonal Calendar and Vision for the future. The report can be made attractive and engaging by using

drawings, photographs, charts or graphs. The questions given in Part B reflection are not for submission. In the discussion section you should inform us in your own words what your learnings have been which will not be possible by merely giving answers to the questions that are provided for guidance.

The teacher coordinator could play a key role in facilitating this exercise, making sure that the team covers a wide range of views and provides sufficient data points to support their arguments.

GUIDELINES FOR WRITING A PROJECT REPORT (PART B)

The most serious problem while writing a report is “Too much description, too little critical analysis and reflection”

What makes a good report?

- It is original.
- It is interesting and easy to read and understand.
- Its purpose and objectives are clear.

STRUCTURE OF THE REPORT

TITLE

Catchy, meaningful, as short as possible

INTRODUCTION

It gives a background of the project. It should link to the title. Write about why you have undertaken the project.

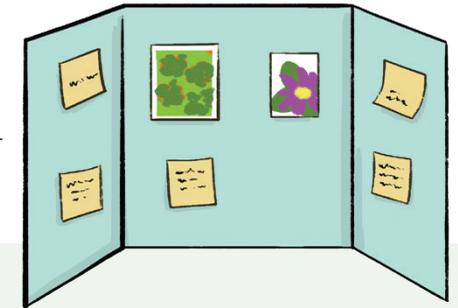
OBJECTIVES

What are you trying to achieve with this project, what kind of gaps in knowledge are you trying to fill? List down specific objectives.

STUDY AREA

Write about the location where you have undertaken this project. Draw or stick a map of your state or district and mark the location on the map.

Present the report in a creative format



Methods

Complete description of precisely what was done to collect and interpret the data or information.

For example:

1. *Primary data collection:*

1.1 *Through direct observations and documentation of Biodiversity (Write about how you went about documenting what you saw)*

1.2. *Interviews*

(Mention about the number of people interviewed, their background, gender, how the interviews were recorded, etc.)

2. *Secondary data collection: books, articles, web search, etc.*

Include any relevant datasheets in this section.

Results

What did you find out? Start with general results and narrow down to specifics

This is the section where you display your data. Include **Historical timeline, Seasonal Calendar, Rich picture** and any other tables or graphs. Use subheadings wherever appropriate.

Discussion

What is it that you learnt from the project? It should be tied back to your objectives

Start by first re-reading your objectives and the main results. Note down the main messages you want to communicate. Start the discussion with the most important points.

Do not discuss results that were not presented in the Results section

Constraints

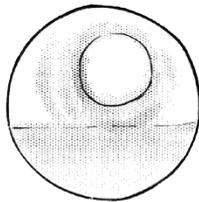
Explain what situations, if any, prevented you from achieving your objectives.

GATHERING DATA

1. PRIMARY DATA is data that has been collected from first-hand experience. Example: Data that you have obtained from surveying your school yard.

2. SECONDARY DATA is data that has been collected from a source that has already been published in some form. Example: Seasonal fruiting and flowering data gathered from interviewing people or from a publication.

Connect your understanding of biodiversity to other areas like:



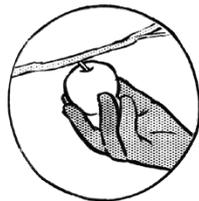
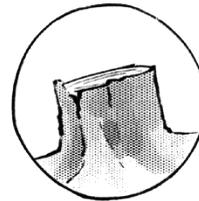
Climate Change

Agriculture, Food Security & Health



Indicator Species

Biodiversity & Ecosystem Loss



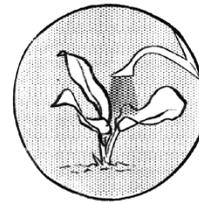
Biodiversity Dependent Livelihood Issues

Relationship with local communities



Indigenous Culture & Practices

Conservation & Adaptation Measures



& More

ROLE OF THE TEACHER

Guide your team in the following ways. By:

1. Providing general guidance
2. Helping students connect the activities with what they study in class and also foster skills of collaboration, enquiry and empathy.
3. Facilitating discussions and group reflection sessions so that everyone can share what they understand, raise questions and together think through what needs to be done. Each activity has leading questions to start off the reflection. Apart from adding your points for the students to reflect on, encourage them to come up with their own views and questions.
4. Encouraging them to talk to their friends, teachers, school administrators, friends and family to get as many perspectives as possible.
5. Building connections to subjects/topics learnt in class, as this will not only help with building a strong understanding, but give clues leading to more reflection. This will come in handy for all activities and Part B of the submission.

Teachers as mentors and guides should help students create their materials but must resist from writing or drawing for them.

Before students go outdoors, make sure they understand, and agree to follow, all safety rules while they are outdoors.

SOURCES OF INFORMATION



Resource books, Newspapers, Published papers



Experts (ecologists, botanists, professors, farmers)



Internet



Forest Department



POINTS TO REMEMBER

1. While trying to make the documentation creative, please do not forget the core tasks/requirements as outlined in Parts A and B.
2. Attempt two elective activities out of the four mentioned here in the activity book.
3. Remember to capture as much data as possible from reflections.

Compile submissions for all the activities into a single pdf or word file, including links to audio and video. Submit the pdf or word file as a soft copy.

FREQUENTLY ASKED QUESTIONS

How much time will this require?

Ideally, Part A activities and documentation should take each team around 3 - 4 weeks, requiring approximately 2 - 3 hours a week. Teachers can assist teams in getting free time from classes to do these activities. Part B requires research and discussions. Research work can be done in free periods or outside of school hours by taking the help of teachers and parents.

How is this useful?

This program is designed as a project-based learning activity and has topics that can be connected to the regular school syllabus. Hence the work done here can be considered for the CCE (Continuous and Comprehensive Evaluation) within the school curriculum.

Participation in the Wipro earthian program will help strengthen concepts in science and social sciences. It will also help with development of language. It also provides the teacher and students opportunities for developing important skills like teamwork, observation, recording, documentation, research, analysis, synthesis, reflection, writing, creative writing and design.

PART A:

UNDERSTANDING BIODIVERSITY IN OUR ENVIRONMENT

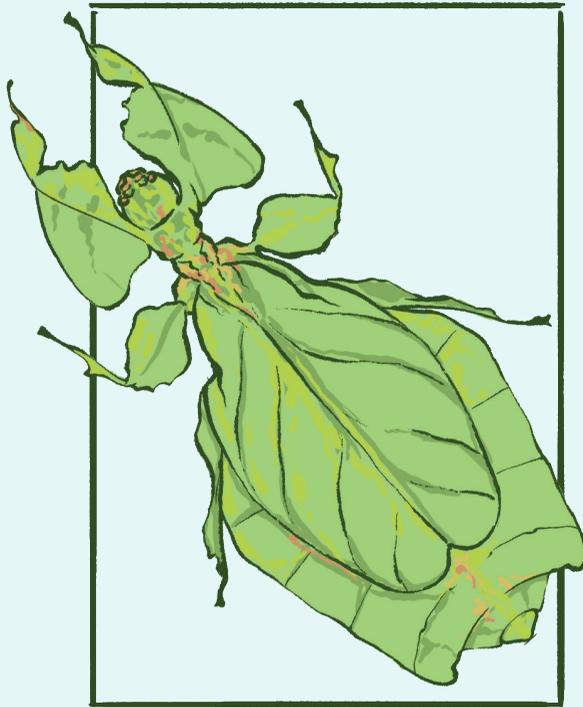
(COMPULSORY)

1. Environment as a Shared Space
2. Species Diversity in Our Backyard
3. Biodiversity and Us (Game)
4. Biodiversity, Food, Livelihood and Climate (Interviews)
5. Biodiversity Threats and Conservation (Case Studies)



ENVIRONMENT AS A SHARED SPACE

ACTIVITY 1



OBJECTIVES

- To explore biodiversity in the schoolyard.
- To connect to local biodiversity using various senses.
- To understand ecological concepts such as symbiotic relationships, prey-predator relationships, camouflage and mimicry.

1.1 BIODIVERSITY INVESTIGATION



MAPPING THE SCHOOL GROUNDS (REFER TO PAGE 25)

- Draw an outline map of the entire school on a full-size chart paper.
- First draw the main buildings and other human-made structures and the school boundary.
- Add details of the various land types such as open ground, grass bed or lawn, treeline, garden with shrubs and herbs and so on.
- Colour each land type to classify them and label them.

CONDUCTING THE BIODIVERSITY INVESTIGATION



2-3 hours

Choose a good time of the day to go out and explore (morning or evening when it is not too hot is ideal). Note down the date, start time, season, and weather. Walk around the school yard as a group and document the biodiversity in the following three steps. In schools which do not have green or open spaces, survey can be undertaken indoors. Refer to the 'Hidden Housemates' bingo sheets for ideas.

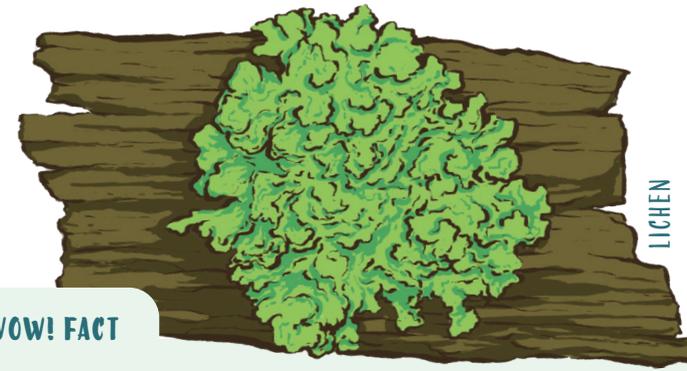
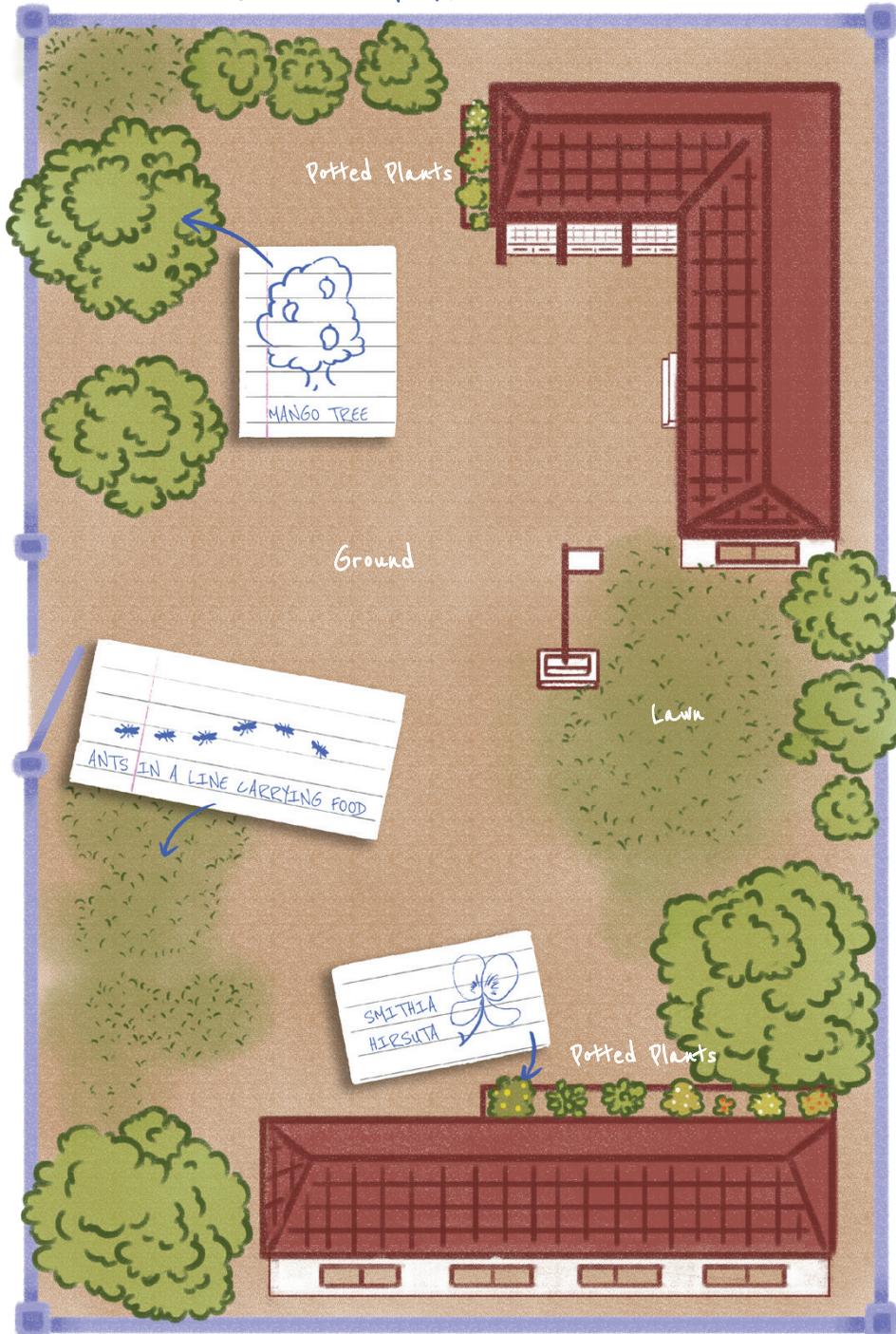
1: Vegetation Survey

During your first walk, pay attention to the plants in the school yard to record the diversity of plants. Take note of any trees, shrubs, herbs, or climbers that look interesting. Even buildings can have vegetation (example: Peepal can grow in the cracks). When you find a plant that looks interesting, make notes or take a picture of it and mark its location on the map. You can either draw and write a few words directly on the chart paper or draw separately, cut the picture and paste it on the map.

While you do not need to know the names of the plants, the ability to look at certain characteristics of plants to determine differences between different plants can be helpful. Notice the leaves, flowers, fruits, structure of the plant and other details. During the time you sketch or look at the plant, write about any insects that you see. If you see that the leaves have been cut or eaten, look more closely at how they were cut or eaten. Do they look diseased? Is the plant without leaves? - all of these things should be written down.



BIODIVERSITY MAP OF OUR SCHOOL



WOW! FACT

Have you noticed a flower-like layer growing on the bark of a tree, stone or a wall? Lichens are unusual creatures. A lichen may look like a plant, but it is not a single organism. It is the result of a partnership between a fungus and an alga. Some lichens are formed of three or more partners. The body of a lichen consists of fungal filaments surrounding cells of green algae and/or blue-green cyanobacteria. This is an example of co-dependence or mutualistic symbiosis. (**Mutualistic symbiosis** is a symbiotic relationship between individuals of different species in which both individuals benefit from the association.)

Lichens are known to be very sensitive to environmental changes and therefore are important indicators of pollution and climate change.

- Look around for lichens, sketch and describe them. Be careful not to confuse moss for a lichen. (Mosses are typically soft to touch whereas lichens are crusty) How many kinds of lichens could you find?
- Look for **fungi** (mushrooms for example) as well as **algae** (in wet areas and surfaces) and compare the form of the lichen with them. Does the lichen resemble a fungus or an alga?
- How do you think lichens reproduce?



Look for a plant with a special feature, such as-

- Spikes or thorns
- Interesting colour or shape
- One that climbs up a structure or 'crawls' along the ground

Why has the plant developed this special feature (adaptation)?



FUN ACTIVITY

Draw the outline of different leaves you see. Notice the similarities and differences between the leaves. Draw the veins of the leaves and observe the arrangement. What does the arrangement of veins tell about the plant?



2: Wildlife Survey

On your second walk around the school yard look for evidence of animals. If you notice a bird, stop quietly for a few minutes and watch. To observe insects and other invertebrates explore the wall, the ground, rocks, leaf litter, bark of a tree, look closely at plants, and so on. If you have a magnifying glass it will be useful to look at small animals in detail. Small wildlife like insects, spiders and geckos hide in cracks in the buildings. Don't forget to look for toads and frogs, snails and slugs in wet areas. When you spot an animal make observations (what did you notice?), ask questions (why, how, what?) and make connections (did it remind you of something?). Document the animal you saw through drawings, words and/or numbers. Some animals, like a moving bird or an insect may be difficult to draw, which is all right.



Look for an animal which is camouflaged - in colour and in shape. Can you identify an animal in your surroundings that has adapted to threaten its competitors and protect itself from predators?

WOW! FACT

Plants and animals use colour and shape to survive. They can use it to hide from other animals, as a warning to scare away animals that are threatening, or as means of attracting animals to them for reproduction.

'Camouflage' is the ability of an organism to blend with its surroundings while 'Mimicry' is the ability of one species to imitate the colour or behaviour of another species.

When you are exploring your school campus make sure to search for the animal which is hiding in the leaves or which could be fooling you by pretending to be an element in nature. There may be animals that could be watching you while you are unaware of them!



The larva of the **Common Baron butterfly** can be found commonly on mango plants. You may overlook these caterpillars if you don't search carefully. Apart from the green colour, the feathery filaments and the pale yellow line running from head to tail add to the perfect camouflage. While resting, the larva often aligns itself along this yellow line, with the midrib of the leaf enhancing this effect!

WOW! FACT (CONTD.)



The **Painted Grasshopper** that you often see on milkweed plants may be the prettiest of insects but not so for the birds. This grasshopper uses its beautiful colours to declare how toxic it is to predators.

The male **sunbird** shows off his colourful plumage to attract a female.



The **Common Mormon** caterpillar that you can find on a curry leaf plant is shaped and coloured like bird poop making it uninteresting to a predator.

What looks like a leaf isn't a leaf but an insect. Yes! It's a **leaf insect** beautifully blending amidst foliage.



This creature that looks like an ant is actually not an ant. It's a spider! An **ant-mimicking spider**. Ant-mimic spiders, apart from the superficial resemblance to ants, also behave like them.



Were the animals you came across colourful or dull? What do you think they used their colours for?

FUN ACTIVITY

1. Print this page and cut out the lizard drawing or trace the drawing on a plain sheet of paper and cut along the outline. Each student will require one animal outline.

Print and cut along the outline

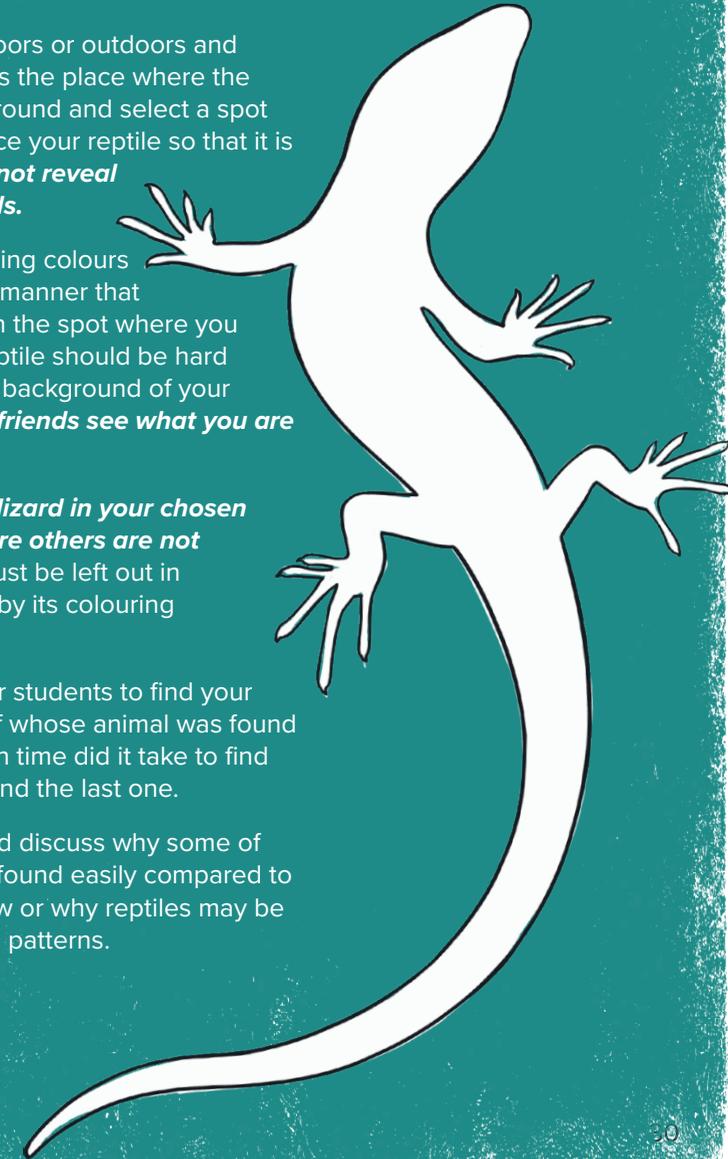
2. Choose an area indoors or outdoors and pretend that this area is the place where the reptile lives. Wander around and select a spot where you want to place your reptile so that it is not easily noticed. **Do not reveal the spot to your friends.**

3. Colour the reptile using colours and patterns in such a manner that the animal merges with the spot where you plan to place it. The reptile should be hard to distinguish from the background of your choice. **Don't let your friends see what you are colouring your lizard.**

4. **Place the coloured lizard in your chosen spot, while making sure others are not looking.** The reptile must be left out in the open, hidden only by its colouring and patterns.

5. Then invite the other students to find your animal. Keep a note of whose animal was found first and last, how much time did it take to find the first paper reptile and the last one.

6. Gather in a circle and discuss why some of your reptiles could be found easily compared to the others. Discuss how or why reptiles may be using their colours and patterns.



WILD ANIMAL HOMES

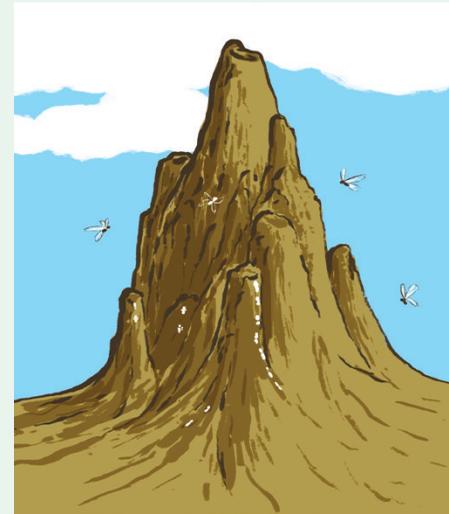
Where do wild animals live? What kind of dwelling places or houses do they call home? Let's find out.

1. Make a list of wild animal homes you know of.
2. Explore both indoors as well as outdoors as a team to look for places where wild animal lives. These may be burrows, nests, ant hills, holes in the ground, wall, etc. If you spot an animal and watch it long enough, you may be able to see where its home is. It could be a bird's nest in the tree, a paper or potter wasp's nest sticking on a wall or a twig, a spider's web, or a termite mound.
3. Without getting too close to this possible home, watch for signs of activity. What is the animal doing and where is it going? Is it gathering or finding food? Is it making any noise? Is it cleaning itself?
4. Document animal homes through sketching and writing notes on a different chart paper or you could use plain sheets of paper and turn them into a booklet. Note down details such as what material has been used, which animal does it belong to, the location, is the home hidden or exposed, etc.
5. Think of all the wild animals that must be living inside your home, sharing the space with you and your family. Discuss if they have their own homes within your home.

Find a minimum of 5 animal homes belonging to 5 different species.



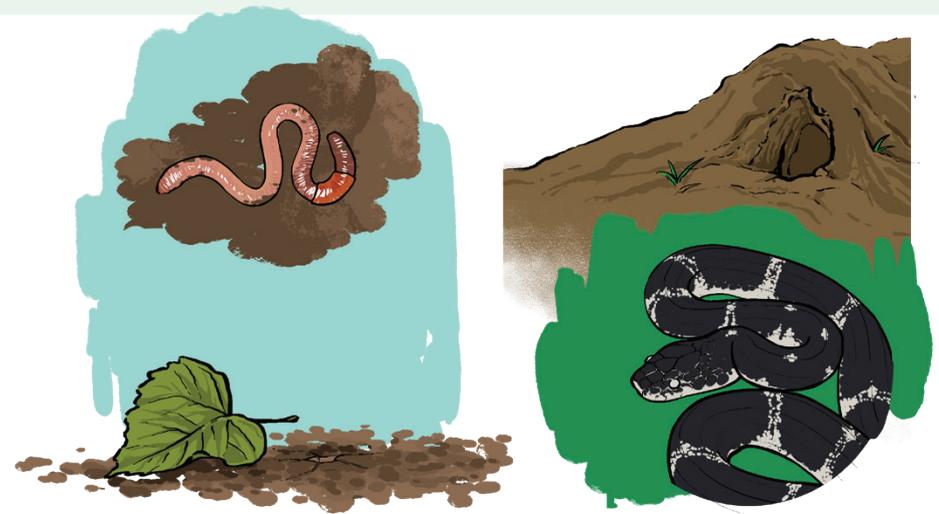
WOW! FACT



TERMITE MOUND

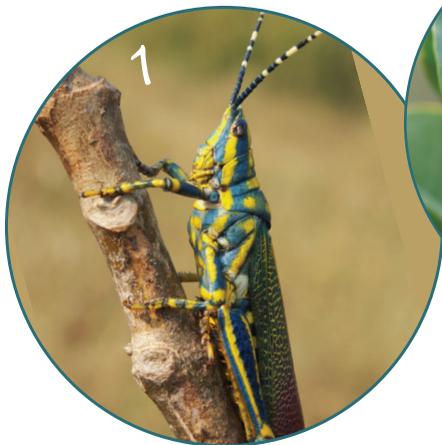
The most notable architects in the animal world are found among the spiders and the insects. Social insects such as honeybees, ants, wasps, termites can house the whole colony in their insect homes. After the rain, hundreds of winged insects fly around our verandah light or the street lamp. They are termites, which build the soil mounds that are thought to be homes for snakes. When termite mounds are no longer used, snakes sometimes find a place to rest in the holes. The termite mounds that these tiny insects build out of soil, water, and their own saliva are just as complicated as human-made castles.

Are there termite mounds in your neighbourhood? How tall are they?

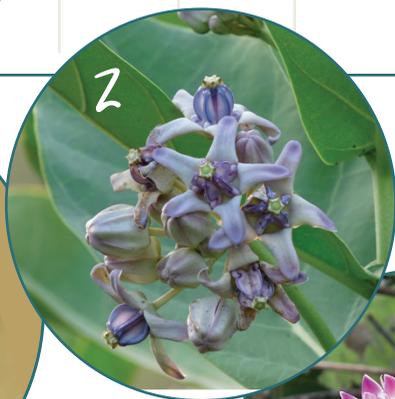


Based on the biodiversity survey check if you spotted the following species in your schoolyard. Mention the local name (if any) Include photographs if possible or make a drawing.

	Species	Yes/No	How many?	Description (species and habitat)
1	PAINTED GRASSHOPPER <i>Roekilocerus pictus</i>			
2	GIANT MILKWEED <i>Calotropis gigantea</i> or <i>Calotropis procera</i>			
3	GIANT WOOD SPIDER / GOLDEN ORB WEAVER <i>Nephila pilipes</i>			
4	SUNDEW <i>Drosera</i> sp			
5	OLEANDER HAWKMOTH <i>Daphnis nerii</i>			



1. Painted Grasshopper - Pradeep717 via Wikimedia commons

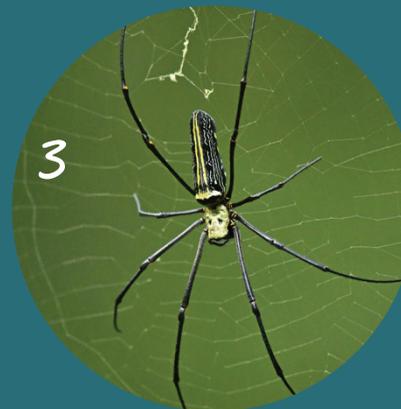


2. *Calotropis gigantea* - Jee & Rani Nature Photography via

Wikimedia commons



Calotropis procera - Wilfredo Rodríguez via Wikimedia commons



3. Giant Wood spider – Subhadra Devi



4. Sundew – Vena Kapoor



5. Oleander Hawkmoth – Subhadra Devi

REFLECTION

- How many different species of plants and animals did you notice in the school yard?
- Did the school have green areas? If yes, which was the largest type of green area (tree cover, grass patch, garden with shrubs or other)?
- Which area in the school had the most diversity of species?
- Did you come across any plant that you were familiar with, that is either edible, medicinal or used for other domestic purposes?
- Were there areas where you did not spot any animal or plant? Why do you think this might have been?
- Do all animals build homes? Did you come across any animal staying in a home built by other animals? What is the major difference you saw between the homes built by animals and the homes we humans build?
- Did you come across any plant or animal that you thought should not exist in the school campus school campus. Why do you feel this way?
- What plants and animals would you like to see in your school campus that does not exist at present?



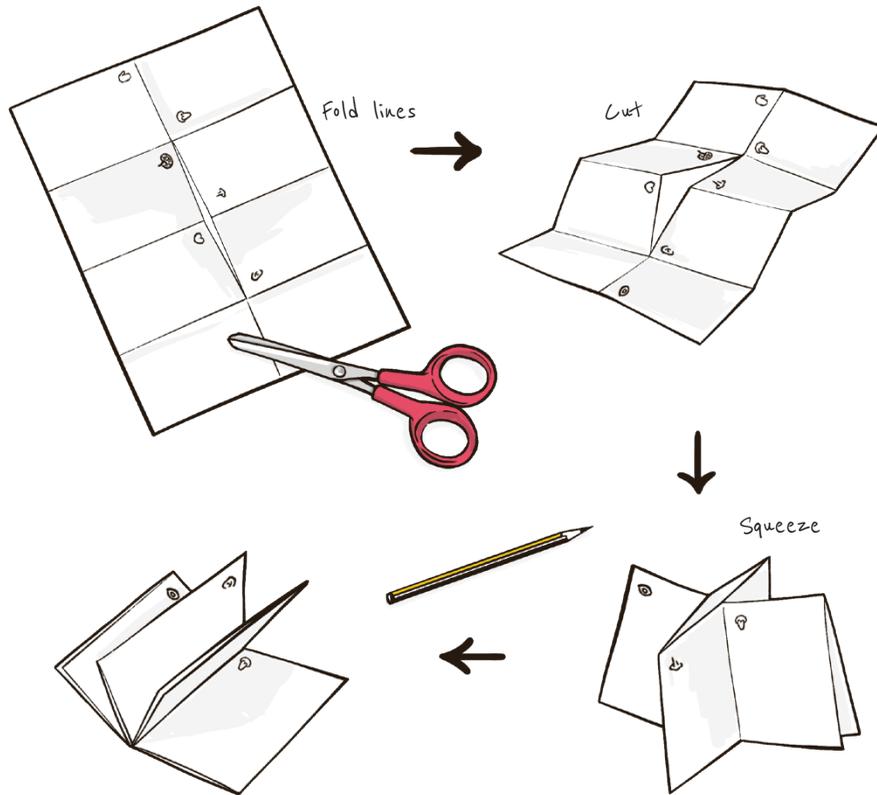
Write a summary of your reflections in a short paragraph or in the form of bullet points. (Essay type submission not required)

1.2 NATURE ZINE (INDIVIDUAL ACTIVITY)

Zine comes from the word 'fanzine' which is a term that generally describes a small, self-published work. It was created originally by science-fiction enthusiasts of the early twentieth century.

 30-40 minutes

 A4 size paper, pen or pencil, scissors



This activity is done by yourself, rather than in a group. Undertake this activity at your house spending time in the garden, balcony or terrace, or if you have access to a safe place like a park or a farm nearby.

1. Take an A4 size sheet of blank paper and fold it into a booklet with eight sides by making a cut in the middle. Follow the instructions as shown in the diagram.
2. Mark each side of the booklet with 7 symbols - eye (sight), ear (sound), nose (smell), tongue (taste), hand (touch), brain (thoughts or memories), heart (feelings), and the eighth side is left blank.
3. Explore your surroundings, watch the sky, listen to calls, sit still, take in the smells. If you find any familiar plant try and taste the leaves or fruits or flowers (avoid tasting if you are not familiar with the plants as several species of plants can cause allergies). Keep all your senses (sight, smell, hearing, touch and taste) alert and record on the zine under the appropriate headings. Use sketches and words to record your observations. For example: In the sheet with the 'nose' symbol write if you smelt something and how did it make you feel or what thoughts occurred to you when you smelt the object. Try to draw from where the smell came from: if it was from a plant or an animal.
4. Once all the 7 sides are filled up, on the blank side of the zine attempt this creative writing activity.

From all the biodiversity observations you have made so far, either at school or home choose an element in nature that you felt close to and write the following-

First line: Name of the chosen nature element (subject / noun)
Second line: Two words describing its qualities (adjectives)
Third line: Three words describing its action (verbs)
Fourth line: Four words describing how you feel about the subject you have chosen (a phrase, sentence or expression)
Fifth and last line: Replace the first noun or rename your chosen subject (synonym).

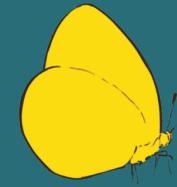
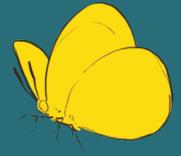
Once you are done writing as per the above instructions make any refinements to your poem.

Sample poem:

Atlas Moth
Delicate Dusty
Flutters Shivers Flies
Making me feel light
Night-beauty



A five-line poem is called a Cinquain



REFLECTION

Gather at school as a group and share your experiences with each other and your teacher.

- Was there anything unique that you came across that you had never noticed before.
- What kind of feelings did this activity bring about?
- How did it feel to spend time alone in nature?
- Describe your most pleasant and unpleasant experience.
- Do you think that the wild animals you have spotted so far use their senses the way you did? Which of the senses may be most useful?
- Will you be interested in doing this activity again or encouraging friends and family to try it out?

ACTIVITY 2

SPECIES DIVERSITY IN OUR BACKYARD



OBJECTIVES

- To investigate species diversity and abundance in micro-habitats.
- To understand that species diversity differs in different habitats.
- To understand human impact on biodiversity of an area.
- To learn sampling techniques, biodiversity monitoring and to encourage scientific thinking.

2.1: COMPARISON BETWEEN MICROHABITATS

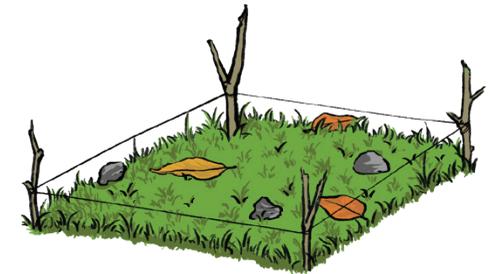
→ A **microhabitat** is a small home environment for plants and animals. Examples are a bush, a garden, individual trees, a pond, area under a pile of rocks, a pile of logs, etc.



45 minutes per observation



- 4 small pencil-sized sticks
- Ruler (Scale) or measuring tape
- String or twine
- A notebook and pen or pencil to note down observations
- Handheld lens or magnifying glass (optional)



1. Find an area in your schoolyard or outside where there is a fair amount of vegetation. Pick a small part of this area which has plants or leaf litter. This is the first “microhabitat” that you are going to investigate. Measure and mark an area with sides of about 1 to 3 square feet to mark the boundaries for your study. Push the 4 sticks into the soil at four corners of the square and tie the string around it to make a box of equal sides.

2. Before beginning the observations, note down the date, time and features of the microhabitat, location and what the surroundings look like.

3. Sit down and closely observe all the living organisms present inside the square for about 15 minutes and make an inventory. Record the numbers of each type of plant, amphibian, reptile, insect and other life forms within

the plot. Use a magnifying lens if required, to observe some of the smaller life forms. **Be careful of animals that may sting or plants that may cause allergic reactions.** Try not to disturb the plot much. Use the data table given below to record your observations. Add as many rows to the table as you need.

Micro habitat 1

Date & time:

Location:

Features of sampling site:

Species Label	List of different species with drawing	Description	Total no. of individuals
A	Ant 1	Big, about 1 cm in length. Black in colour	8
B	Elephant Grass		10

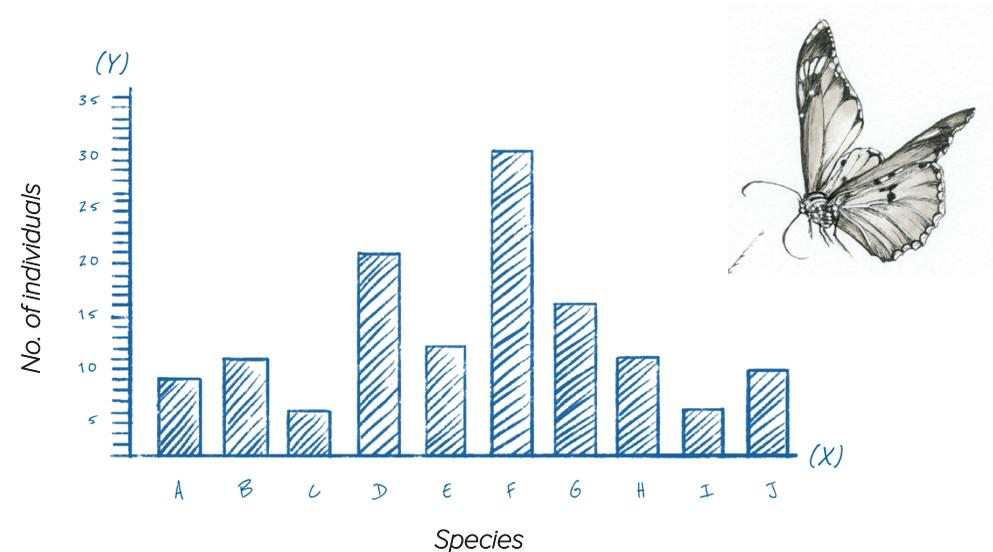
As the intention is to observe the diversity of life, it is not necessary that you should know the name of each species you see. You could record different species as Insect 1, Insect 2, Grass1, Grass 2, Spider, etc., along with a short description and drawing. Give each species you record a letter. For example, label them A, B, C, D, and so forth. This will be useful later to create a graph.

After you have listed the animal or plant species, count and record the number of individuals of each of each species and note down in the last column. This is called **Species abundance**. You can mark the animal found to be living there as Resident (R) and those passing through as Passing By (PB).

4. Pick a second microhabitat - this time find vegetation growing above ground like on the trunk of a tree, on a fallen log, above the rock, on a tiled roof or discarded machinery, etc which may consist of moss, ferns, liverworts growing on them. Mark a square that is the same size as the square in your previous microhabitat. Similarly investigate and record all the animals and plants you notice in the second data table titled Micro-habitat 2. Look carefully for small insects and other invertebrates like spiders, earwigs, beetles, etc.

5. Repeat the observations in each microhabitat atleast 2-3 times, since this increases the chances of finding more animals using this habitat.

6. Use the data you collected to display your findings visually using a bar graph. Prepare two separate graphs for two different microhabitats. Enter data from column 1 (Species Label) on the (X) axis and the data from the last column (total no. of individuals) on the (Y) axis. Establish the value for each line on the (Y) axis - for example, in the range of 5, 10, 15, 20....or 50, 100, 150, 200....



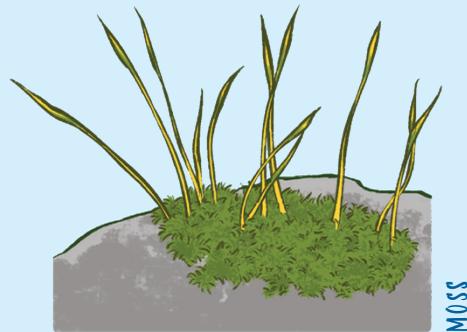
REFLECTION

- Did you find anything that you never knew existed before?
- Were the numbers and types of plant and animal species different for different microhabitats? What could be the reasons for these differences?
- Where do the plants in the microhabitat above ground get water and nourishment from?
- Do some animals seem to prefer certain types of microhabitats (such as damp ones or dry ones) more than other animals?
- How did the plants and animals in these two habitats benefit each other mutually?

(Write a summary of your reflections in a short paragraph or in the form of bullet points.)

WOW! FACT

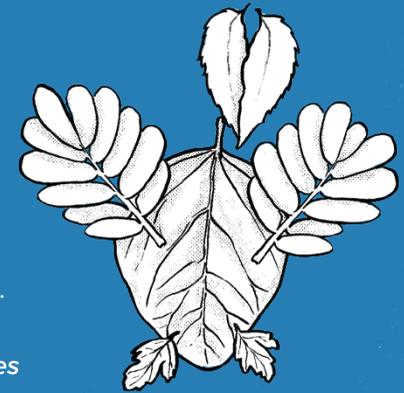
True mosses are primitive plants that existed 300 million years ago and have barely evolved since then. New moss plants are produced by spores that spill into the wind from slender stalked vase-like structures.



FUN ACTIVITY

Collect fallen leaves. Create an imaginary animal by cutting and sticking these leaves on a paper or chart. Give it a name and describe the habitat of this imaginary animal as well as its diet. Remember that the diet this animal is dependent on should also be obtainable in this habitat.

Where does your imaginary animal fit in the food chain? Does it have any adaptations and what does it use this for?



2.2: COMPARISON OF AVIAN (BIRD) DIVERSITY IN DISTURBED AND LESS DISTURBED HABITAT

 30 minutes per observation



- 2 Shallow water bowl (clay or metal) not more than 2 inches (5 cm) deep.
- A few pebbles or a stone (place them in the bowl of water)
- Regional, age appropriate bird field guides.
- Notebook and pen or pencil to record observations

1. Choose two different spots to place the bird bath (shallow bowl of water for birds). Place one bird bath in a less disturbed area, preferably surrounded by vegetation which birds can use as a cover. The second bird bath is to be placed in an open area where there is a lot of human movement and no vegetation cover. ***Both the bird baths should be placed at a safe height so the birds are safe from cats.***

2. It may take a few days for the birds to spot the bird bath and feel safe enough to begin using it. Before starting your experiment you have to find out what time of the day the birds prefer to visit the bird bath. Therefore, for the first few days watch the bird bath from a safe distance at different times of the day (morning before school assembly, lunch break, evening after school).



3. Once you have an idea which time of the day birds prefer to visit the bird bath, fix this time for monitoring the bird baths every day. Form 2 teams and spend about 30 minutes watching the two bird baths at the same time from a safe distance so as not to disturb the birds visiting the bird bath. As you watch the birds drink water or bathe in the bird bath, you should be able to get a close look at them if you stay still and quiet. If possible, use a pair of binoculars so that you can see the birds clearly. Keep the bird guide handy, so that you can identify the different species of birds that visit your water bowl. If you cannot identify a bird, write as unidentified #1, unidentified #2 and so on and describe how it looks.

4. Document the species of birds that visit the bird bath in the table below.

Date:				
Start time:		End time:		
Weather:				
Sl. No.	Common (English) name	Local name	No. of individuals	Description



Make two separate tables for different bird baths. In addition, make notes on how the birds bathe, were they very alert & looking around or calm? Were there any vocalizations? What was the sequence of activity? and any other observations

5. Monitor the bird baths for at least a week. **Ensure that the bird bath is cleaned every morning and filled with fresh water. Algal or fungal formation should be prevented in the bird bath in order to prevent wild birds from contracting diseases.**

6. Calculate the **Species Richness** of each spot by counting the total number of species (not individuals) observed in each spot. Compile the **Species Abundance** (total no. of individuals for each species) data in the format as shown below to make comparisons between the two sites.

	Sp1	Sp2	Sp3	Sp4	Sp5	Sp6	Sp7	Sp8
Site 1 (with veg cover)								
Site 2 (open area)								

*Sp = Bird Species like House Crow, Spotted Dove, Magpie Robin, etc

Species diversity in a habitat is related to both species richness (number of species) and species abundance (number of individuals of each species)

WOW! FACT

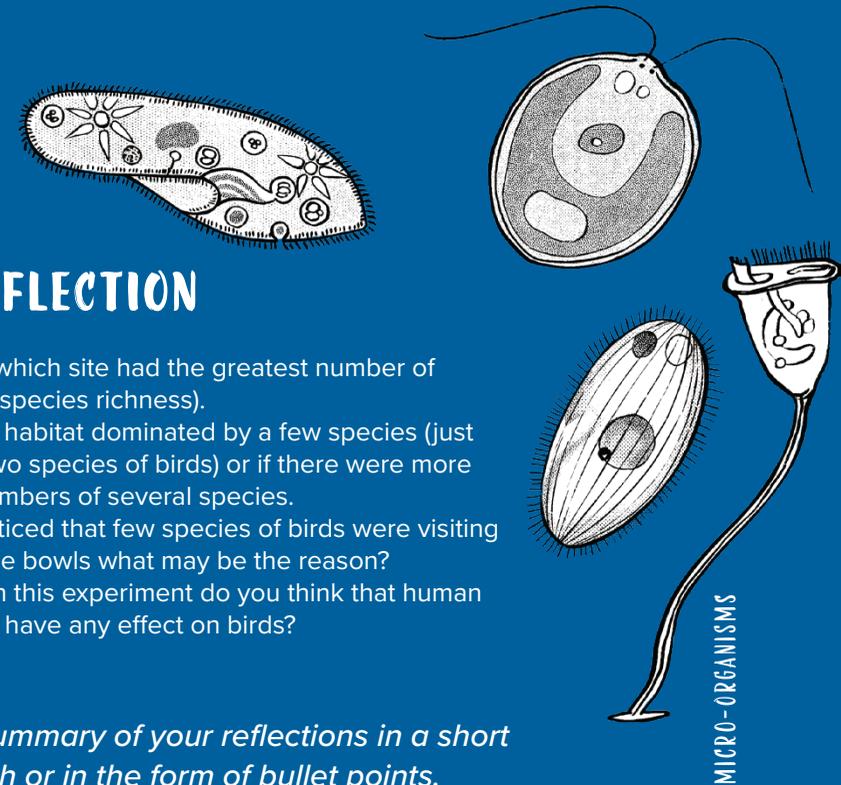
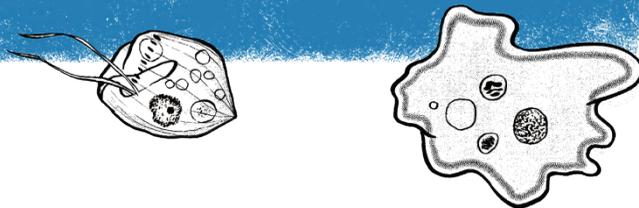
Birds have peculiar types of “bathing” other than bathing in water. A “dust bath” is an unusual type of bath that is part of a bird’s preening and plumage maintenance that keeps feathers in top condition. You will also notice birds sun bathing with their wings spread out. Birds also practice ‘anting’ for a number of reasons, like getting rid of parasites.



FUN ACTIVITY

You have seen several kinds of plants and animals. However, there are other living organisms around us which we normally cannot see. We need to use a microscope to see them. These are called microscopic organisms or microbes which include algae, bacteria, fungi, protozoa, viruses and other groups.

Collect some water from a nearby wetland - pond, stream or rainwater puddle. Put a drop of water on a slide and place a cover slip over it. Examine under the microscope. Similarly collect some moist soil from the garden or field in a clean beaker or container. Add filtered water to it. After the soil particles settle down, take a drop of this turbid water and observe under a microscope. Do you find tiny organisms moving around? Notice the shape, size, and number of different colonies of the microorganisms. Identify them with the help of books or by consulting your biology teacher. Draw them and name them.



REFLECTION

- Discuss which site had the greatest number of species (species richness).
- Was one habitat dominated by a few species (just one or two species of birds) or if there were more equal numbers of several species.
- If you noticed that few species of birds were visiting one of the bowls what may be the reason?
- Based on this experiment do you think that human activities have any effect on birds?



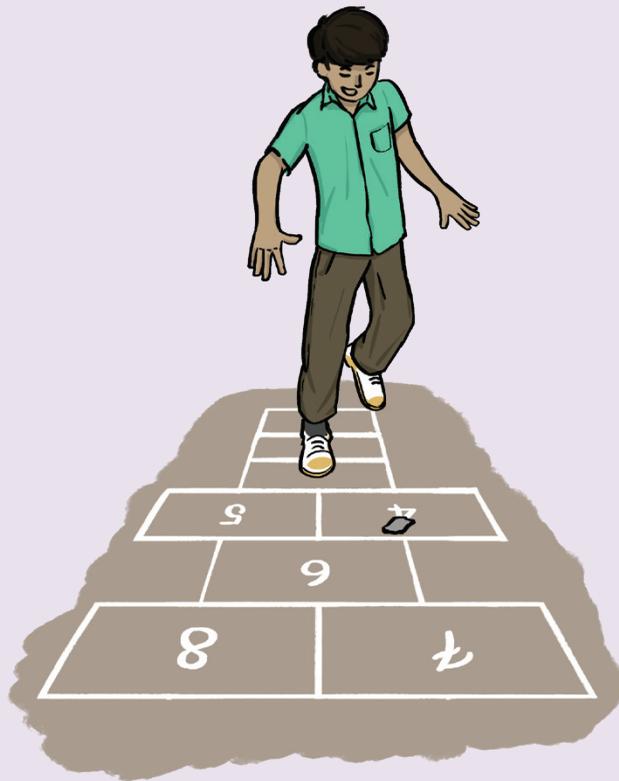
Write a summary of your reflections in a short paragraph or in the form of bullet points.

EXTENSION: Species diversity varies during different seasons and different years. Species can move therefore increasing or decreasing in certain seasons. Species abundance can also be variable. Some species, both plants and animals, do not reproduce during certain seasons or during years with low rainfall.

Monitor your sampling plots and bird baths even after submission of this assignment, in different seasons. You can undertake monitoring on a weekly basis, monthly or quarterly. Encourage other students in the school to join you in monitoring. You can also increase the number of sites to monitor thus making comparisons between more than two sites. This can be presented as an annual science project at school.

BIODIVERSITY AND US (Game)

ACTIVITY 3



(PICK ANY 1)



OBJECTIVES

- To understand interconnectedness in nature.
- To learn about services that humans derive from nature.
- To explore the connection between biodiversity, people and culture.

All of the lives of people who live in an area are influenced by the biodiversity of that region. They need the **ecosystem services** that biodiversity provides in order to live and work in their own space and make a living.

Humans gain many benefits from the biotic and abiotic components of an ecosystem. These benefits are called ecosystem services.

We don't see this very often because it isn't always obvious. Our drinking water, the air we breathe, the soil on which our food grows are all influenced by a wide range of living organisms and the ecosystems that each one is a part of. While it is well known that plants remove carbon dioxide and release the oxygen we breathe, it is less well known that fungi, small soil invertebrates, and even microbes are important for these plants to grow.

Our well-being and long-term survival depend on the conservation of biological resources, so it is important to keep them safe.



This is a Hopscotch game that contains 8 blocks and players must hop from one block to another. The player must hop on one foot in single squares, and land on two feet in squares placed side by side.

1: STORY OF THE FIG - Outdoor Game

2: BIRD MIGRATION - Indoor Game

(Game sheets are enclosed with this booklet.

Pick any one game)



40-60 minutes



Chalk, Flat stone or a piece of tile, Game cards, black/white board or paper to note down the scores.

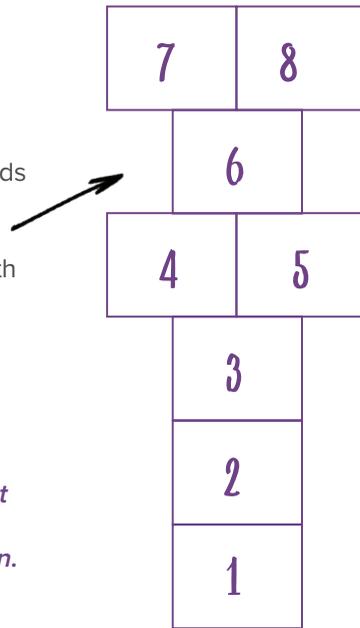


Number of players: Minimum 2, maximum 8

Getting ready

- Print the enclosed game sheets and cut the game cards (total of 8 cards).
- Form 2 teams. Choose who will play first by tossing a coin or other methods familiar to you.
- Draw the grid on the ground using chalk or scratched out in the mud with numbers marked inside the squares.
- Place the cards in their respective squares.
- The flat stone or a tile piece will be used to toss within the grid.

Each game card has information about the species represented in the game followed by instructions to do an action.



How to play

Members of each team should stand in a straight line (side by side or behind each other)



→ **Step 1:** One member from **Team A** must go forward to play. Standing behind the starting line the player has to throw the flat stone in Block number 1. He/she has to then hop over the first block then to the second block and continue hopping to the seventh and eighth block, then turn around, hop back to the second block, pause and pick up the card as well as the stone, hop in the first block and return to the starting line. The player should then read out the text on the card to both the teams. One player from **Team A** and one from **Team B** should simultaneously run to complete the action described in the card. The remaining team members stay in place. The member who finds the object first gets 1 point for his/her team.



→ **Step 2:** One member from **Team B** steps forward, tosses the stone in Block number 2, hops around the grid as instructed in Step 1 and picks up the card in block 2 and returns to the starting line. As in Step 1, the contents of the card are read out, and the next set of players (one from each team) run to do what is instructed. The teams should appoint different sets of members to carry out the action so everyone gets an opportunity to play.

→ **Step 3:** It's **Team A's** turn again. The player tosses the stone in Block number 3 and does a full loop. The two teams take turns to toss the stone and this continues until the last card in Block number 8 is picked up and the action relevant to that card is completed.

The player who is unable to toss the stone into the right block or steps on the line while hopping will miss a turn. The chance goes to the other team.

The team with maximum points is considered the **winner!**

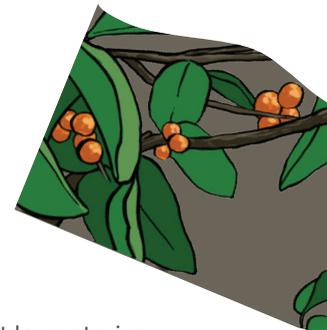
JIGSAW PUZZLE

After the hopscotch game is completed read the story below. Join all the game cards together (text side below) to find the species mentioned in the story.

JIGSAW PUZZLE 1: STARS OF THE RAINFOREST

This bird associated with the fig is the star of one of the best love stories. The story starts with the male presenting a ruby red fig to the female during courtship. It is a sign of his ability to provide for his future family.

When the pair decide to start a family the female bird enters a hollow in a tall tree – a safe haven in which to lay her eggs and raise her chicks. To strengthen her protection, she and her partner seal up the hole with mud and regurgitated figs, leaving only a slit unsealed. For the next four months, the male bird spends his days finding food, and brings figs home to the female, and later for the chicks as well. In time, the mother bird will join this daily mission of bringing food. When the young birds emerge, they take to



the skies with a strong taste for figs. Like their parents before them they will feed on figs for life. As they do, they will disperse the fig seeds, ensuring a food supply for future generations, just as their great grandparents did before them.

Join the cards together to find out the stars of this story

If your neighbourhood has fig trees, observe them during fruiting season. You may be able to spot this star bird.

JIGSAW PUZZLE 2: CELEBRITIES OF MIGRATION

It's the month of October and the high-altitude wetlands are covered in snow. Fuelled by the extra fat they gained by eating lots of tender grass and grains in swampy lakes, this flock of waterbirds leave their home in Tibetan plateau to spend the winter in India.

But to reach India they will have to cross the mighty Himalayan mountains. At this height about 5000 to 8000 meters, temperatures are so low that exposed body parts can freeze instantly and oxygen levels drop by one-third that at sea level. But they are hardy birds. They are so strong that they can fly in crosswinds without getting blown away. Their powerful and constant flapping of wings while flying helps generate body heat which is retained by the down feathers (small, soft fine feathers that are closest to the skin). The heat helps keep ice from building up on their wings when flying over mountains. These birds also have a special type of haemoglobin that absorbs oxygen quicker and they have proportionally larger lungs than other species of waterbirds. The flock of waterbirds cross the Himalayas during the night in 7–8 hours. Considered the world's highest bird migration, mountaineers have claimed to have seen the birds fly over Mount Everest. They stay in the India plains till April and can be seen in wetlands across the country all the way till Kanyakumari.

Join the game cards together to find who these celebrities are.

If your neighbourhood has water bodies, monitor them during the winter season for migratory birds. You may be able to spot these athletic birds.

WOW! FACT

Migration is the seasonal movement of animals from one place to another. Bird migration is one of nature's great wonders. It is the annual movement of all or part of the population from their breeding grounds (place where they reproduce) to non-breeding grounds in search of food. Migratory birds typically travel from regions of extreme climate to regions of moderate climates, and back.



REFLECTION

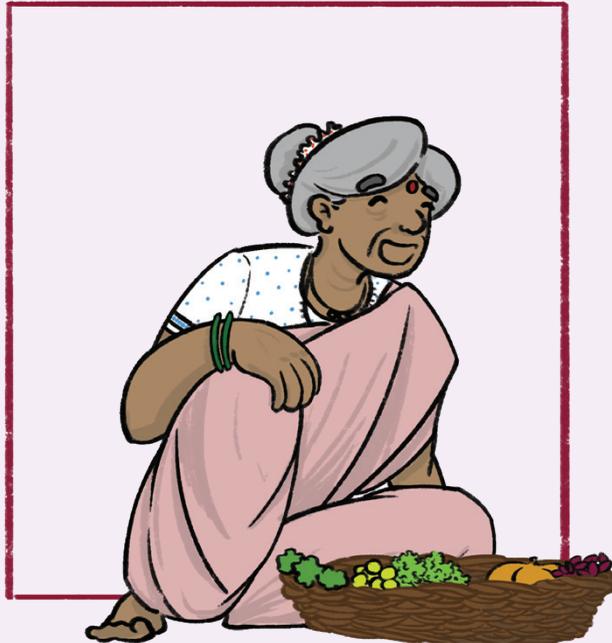
- Were you familiar with the species (Fig / Pied Cuckoo) represented in the game? If yes, how?
- What connections did people have with these species in the past? Do you think these connections are reducing; and if so why?
- Do you think there is a disconnect to these species now? If yes what may be the reasons?
- If a species of Fig or a migratory bird like the Pied Cuckoo becomes extinct do you think the life of humans will be affected? And how?



Write a summary of your reflections in a short paragraph or in the form of bullet points.

ACTIVITY 4

BIODIVERSITY, FOOD, LIVELIHOOD & CLIMATE (Interviews)



OBJECTIVES

- Understanding the links between biodiversity, food security and livelihood
- Exploring the attitudes of people towards biodiversity and conservation
- Understanding impacts of current climate change

As part of this activity, you will undertake interviews that are **Qualitative** by nature. Qualitative interviews consist of conversations, but they differ from normal, everyday conversations in several ways. Qualitative interviews take the form of a two-way conversation, with discussion and follow-up questions on each point, rather than a question-and-answer session with no discussion. The interviewee should do most of the talking. Your task is to encourage them to talk openly and freely yet stay more or less on the subject, with as little direction or interruption as possible.

'Informal', 'unstructured' and 'semi-structured' interviews are generally regarded as Qualitative interviews.

4.1 PREPARING FOR THE INTERVIEW



- Choose the communities you will interview and how many people from each community you will interview.
- Prepare a list of guiding questions you would like to ask and get feedback from your teacher.
- Determine an approximate duration of the interview so you can inform the interviewees in advance.
- Decide how you are going to record the interview – taking notes, audio recording or both.
- Discuss and decide if each of you will conduct the interview individually or meet the interviewees together as a team. If conducting an interview as a team, decide beforehand who is going to introduce and begin the interview and who will end it, who will ask which question and who will take responsibility of recording.
- Contact the people you wish to



interview and take appointments for a visit unless you are requesting people spontaneously on the street, field, park or other outdoor spaces.

Type of Interview: Semi-structured

Semi-structured interviews are formal conversations based on an interview guide (a list of questions or topics to be covered) that is prepared in advance. The interview guide may act simply as a checklist to make sure that the key points are all discussed, or it may be a list of questions that are asked in sequence. In this interview format the discussion can go back and forth with the interviewee rather than strictly sticking to the questionnaire.

Sample questionnaire. Prepare the list of questions based on the background of the person you are interviewing.



Information about the interviewee

- Date of interview:
- Name
- Approx. age
- Gender

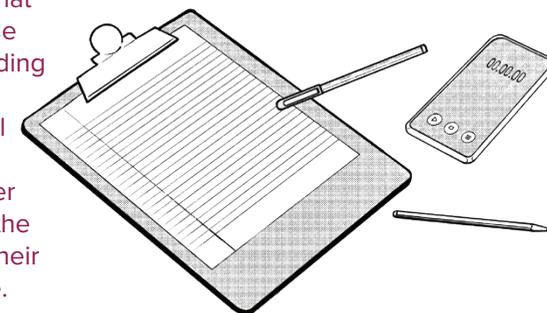
Generic questions

- How long have you been living in this area?
- Were you born here or did you move from somewhere else?
- What is your occupation? What is your current source of income?

Agricultural diversity

- What is the main staple food you consume? Is this grown in the region?
- Has there been any changes in the kind of food you consume in comparison to what your parents and grandparents ate?
- Were the crops that are currently grown in the region grown since the time you remember or have you seen changes? If yes, what is the reason?
- Have you seen any changes in the kind of farming methods - use of fertilisers, machines? If yes, when did this change happen? Has this affected your lifestyle in any way?
- Do you consume any wild edible plant and which time of the year are these plants available?
- Are there any wild edibles that you used to consume and are not available anymore? If yes, what may be the reason?

Before starting the interview, ensure that you have clearly explained the purpose of the interview, that you will be recording the answers, and you will be sharing the answers with others in your school and beyond. Ask the person whether they have understood this and whether they consent to be interviewed. Start the interview only if they clearly indicate their consent; else approach someone else.



Livelihood

- Are there any plant or tree species in the area that people are currently dependent on to make a living?
- Apart from people, have you seen other animals dependent on this plant or tree?
- Have you noticed any changes to the fruiting and flowering of this plant or tree species in the last 20 years or 40 years?
- Is there a plant or animal that you used to consume or use in any other way that you don't find any more in your environment? If yes, why do you think it disappeared?

Climate

- When in your life have you experienced the hottest summer and the coldest winter? Do you remember the year?
- If you compare temperatures between when you were young and today, can you notice any changes? If yes, what are those changes?
- Has the monsoon changed in your area during the last 20 or 40 years? If yes, how?
- Is your region more affected by droughts or floods today than 20 or 40 years ago?
- Have you noticed any other changes in the weather? If there are changes how have they affected your and your family's life? How have these changes affected the nature of your area?

FUN ACTIVITY - ATTITUDE ASSESSMENT

Make three smiley face drawings, one **Happy**, one **Sad** and one **Neutral** (neither happy nor sad). Prepare a list of statements that can stimulate different different emotions in people (find example statements below). Read out a statement and ask your audience to pick a smiley based on how they feel about your statement. Examples of Attitudinal Survey Statements:

1. You wake up to the call of a bird sitting and singing by your window. How does it make you feel?
2. You hear from scientists that rare variety of plants and animals that are not found anywhere else in the world are present in your area. What do you feel about it?
3. Your area is getting a new wide road. This means all the old banyan trees along the existing road will have to be cut.
4. A big industry will be set up in your area by filling up a waterbody. But they promise to provide several jobs to the locals.
5. As you are walking home in the evening you see hundreds of birds flocking together before settling down on a tree for the night.
6. You are sitting in front of an ancient tree in the evening, and you see hundreds of Bats (Flying foxes) emerging out of the tree and flying out to look for food.
7. You hear from an elder that big wild animals once roamed in the area, but they were all hunted down and wild places converted for development.
8. An area that was meant for a public park has now been sanctioned to be restored and reserved for wildlife because of a petition filed by environmentalists.
9. You see large sized birds nesting on a mobile tower as there are no old trees left in your locality.
10. Add your own questions....



4.2 CONDUCTING THE INTERVIEW



Find people in your locality belonging to at least two of the following groups.

- Local community members who are directly dependent on local biodiversity for livelihood. Example: Fisherfolk, fuel wood collectors, shell collectors, tribals who use wild plants for consumption and sale, basket or mat weavers, honey collectors, thatch-roof makers, etc.
- A farmer or a family that owns livestock.
- Member of the Forest department, conservation NGO or activists involved in conservation of biodiversity.
- Owner of a small-scale business unit who is indirectly dependent on local biodiversity. Example: Local vegetable vendor, flower vendor, tender coconut seller, gardener, homestay owner, fishmonger, boatman, brick-kiln owner.

Interview at least 2-3 people from each of the groups. Find people belonging to different age groups and gender. Interviewing several individuals or groups will capture variation in experience. For example, interview people belonging to your parents' generation as well as grandparents' generation as their knowledge and experience will be different. Also, the perspective of women and men will vary and interviewing both will give you a complete view of the topic you are trying to understand. There is no upper limit for the number of interviews you wish to conduct.

Talk to the interviewees individually or as a group. The less you direct the conversation and the more you gain the trust of the interviewee, the more 'accurate' the information that emerges – in other words the more closely it will reflect the interviewee's knowledge, attitudes, and opinions.

Group interviews

When you are interviewing a group of people, all the members should belong to the same unit. For example, members of the same family, people working in the agricultural fields, a group of forest department staff, a group of women collecting seashells, etc. Parks and religious places are best to meet groups of elderly people.



INTERVIEWING TECHNIQUES

- Greet the interviewee.
- State the aim of the interview.
- Ask for consent to record and click photographs.
- Listen carefully and give them enough time to respond.
- Once you have covered all your questions, ask if there is anything they would like to add or to ask.
- Thank them for their time.

PRACTICAL TIPS!

- After preparing the guiding questions, conduct mock-interviews with other class members. Note down the approximate duration of the interview so you can inform interviewees in advance.
- Start with some small talk to build rapport. Don't just plunge into your questions, make your interviewee as comfortable as possible. You can use the Attitude Assessment activity as an ice-breaker.
- While you are making notes, make sure you continue to engage with the informant – make regular eye contact and keep the conversation flowing.
- If one of you in the team has a question that you feel is important to ask, wait till the previous question is answered.
- Make interviewees feel like their answers are very important to you and be respectful of the time they're sparing to help with your project.

Always show professional courtesy. This includes respecting their right not to answer (so not pressing them too hard about issues they do not want to discuss) and not telling others what they have said without their permission.

(Part B (Ecological History) section of this booklet requires gathering information from local people. If time permits it will be useful to ask questions from Part B to these set of people)

4.3 INTERPRET THE FINDINGS

Organise your data. Make comparisons of knowledge and attitude across professions, gender and age group.

'Wordstorm' your ideas - Write out answers or points on separate strips of paper or post-its. Group and re-group into logical order. Link and order answers and points that are closely connected

		Agricultural Diversity	Livelihood	Climate
Gender	Male	[Yellow]	[Blue]	
	Female	[Yellow]	[Blue]	
	Other			
Age	Youth			
	Middle Age		[Blue]	
	Older	[Yellow]	[Blue]	[Green]
Occupation	Farmer	[Yellow]	[Blue]	[Green]
	Forest dept. personnel			[Green]

REFLECTION

- Has there been a big change to the kind of food consumed and sourced? How has this affected the health and nutrition of the people? How has this affected local biodiversity?
- Have there been major shifts in livelihood options over the years? How has the shift affected people's dependence on local biodiversity?
- Are there any key species that have disappeared from the region?
- Are people aware of climate change? What is their attitude towards it?
- Is there a difference in attitude towards local biodiversity between those who are in the profession of protecting biodiversity compared with those who are dependent on biodiversity for livelihood?



Write a summary of your reflections in a short paragraph or in the form of bullet points.

BIODIVERSITY THREATS AND CONSERVATION

(Case Studies)

ACTIVITY 5



OBJECTIVES

- To understand anthropogenic (human caused) activities that bring about changes to biodiversity.
- To learn about grassroots level action to conserve biodiversity and factors involved in biodiversity conservation and management.
- To use role play as a tool to encourage self-reflection and dialogue, and create a platform for students to express concerns.
- To learn to work as a team in finding innovative solutions to local biodiversity related issues.

With a population of more than 1.38 billion, and an enormous need for development to meet the aspirations of the people, India is experiencing an alarmingly rapid loss of biodiversity both in aquatic as well as terrestrial ecosystems, and significant change in land use and land cover.

Biodiversity conservation involves the protection and management of biodiversity. The goal is to preserve the diversity of species, utilize species and ecosystems sustainably, and maintain life-supporting systems and essential ecological processes.

Addressing biodiversity threats is complicated. A single perspective or a single solution is not sufficient to conserve biodiversity. Several complex decisions must be made. For example, How do we protect nature while also ensuring economic development that is fair and inclusive? Which species are the most critical to save? What happens if saving one species means that we cannot use limited resources to save another?, etc.

Therefore, a diversity of perspectives is needed to understand the complex dynamics affecting biodiversity, such as economic development, politics as well as cultural, artistic and spiritual views on nature and peoples' relationship to it. Coming together of communities, governments and non-governmental organizations on a local, regional, and global scale is needed to ensure that solutions meet the different needs of both nature and people.

Creating a biodiversity-friendly environment at community or local (grassroot) level is a small but important step towards biodiversity conservation. If everyone starts caring about the local environment, then time will come when every species around us will be safe.



Five case studies from five different geographical locations and ecosystems are listed here. Pick any one case study and follow the instructions to complete the activity.

STEP 1: Prepare a mini drama based on the chosen case study. After you have rehearsed sufficiently, perform in front of your class members and teachers on a designated day. Hold a discussion about the issues that have been presented in the case study for about 10-15 min.

- What were the biodiversity threats you came across in your case study?
- Who was responsible for inducing the threat?
- Who benefits the most from the proposed activity that threatened biodiversity?
- Which others were negatively affected by the threat?
- What activities or interventions took place to counter this threat?
- When and how were these activities or interventions implemented?
- Who was responsible for the implementation of these responses? Was it a collective action or an individual effort?
- What were the results of the intervention?
- What lessons do you take away from the case study?



Instructions for preparing for the Mini Drama

1. Read the case study, discuss among the team and filter out the message to convey. Pick what events you want to act out from the case study keeping it simple such that the drama can fit within 10 minutes.
2. List the characters (people, plants, and animals)/ actors / props / scenes in the case study. Example: Community members, plant or animal species being represented, government employee, wildlife biologist, NGO worker, media personnel and so on.
3. Take on the role you are comfortable playing and rehearse.
4. Before you perform, introduce to the audience what event or topic is being played and what roles are being played by whom.

→ **STEP 2:** Along with your class members, think of a similar biodiversity threat that you may be aware of in **your area**. Come up with an **action plan** or **campaign** to reduce the threat and protect the species or ecosystem. Use a flip chart or black board to note down your discussion points.

→ **STEP 3:** Compile the discussion points and create a poster of the **new case study**. Include title, location, threats, action points, people involved and possible outcomes.



REFLECTION

Use these as indicative questions to discuss the case study from your area and to design the poster (refer step 2 and 3)

- What were the actions and circumstances that led to the main threats to biodiversity in your area?
- Who is responsible for the threat?

Who is the most **AFFECTED** by the threat?

Who **BENEFITS** the most if biodiversity in your areas is lost?

- Who will be the key people you would like to be involved in biodiversity conservation and at what stages?
- What kind of challenges will you probably face in bringing these key people together?
- Does the issue have any cultural or political connections? Can it be resolved locally?
- What possible solutions would you propose to reduce or stop the biodiversity threat?
- Of the solutions you propose, think about what actions can be undertaken by individuals or groups of citizens; which ones need legal interference.
- Will your proposed solution have short-term or long-term effects?



Record a video (phone recording will be sufficient) of the performance as well as the discussion. Submit a video clip and poster of the new case study.



CASE STUDY 1: ADDRESSING CONFLICT BETWEEN PEOPLE AND WILDLIFE IN THE HIMALAYAS

Spiti Valley is a cold desert in the Himalayas which is home to around 31000 people. It is also home to one of the most beautiful big cats in the world - the **SNOW LEOPARD**. People here have shared their space with this wild cat since time immemorial. But with changes in the way the landscape is used now such as intensive livestock grazing, the natural prey of the Snow Leopard such as Blue Sheep, Himalayan Ibex, Argali, and the Himalayan Tahr have been decreasing. This has forced the Snow Leopard to feed on the villagers' livestock thus causing severe economic loss to the villagers. In retaliation the owners of the livestock harm the Snow leopard.

The numbers of Snow Leopards are already in decline. Since the Snow Leopard is an apex predator (predator on the top of the food chain), its disappearance would likely lead to a number of negative effects on the ecosystem.



Photo: Irbis1983 via Wikimedia Commons

In the Kibber Village of Spiti Valley the local community with the support of a nature conservation NGO came forward to tackle conflict between people and wildlife by setting up a few grazing-free reserves to help the wild herbivores thrive. In addition, a community-run livestock insurance program was also set up to offset the economic losses that local people were facing due to livestock predation by the Snow leopard. Traditionally, local people kept their livestock in a corral - an enclosure that is open from the top - which was not secure against Snow Leopard attack. The nature conservation NGO also provided predator-proof corrals in the village thus reducing livestock predation.

The attitude of Kibber villagers towards wildlife conservation has changed because of this intervention. They even stop outsiders from hunting wild herbivores.

→ **Additional threats:** The Himalayas are a fragile ecosystem, and are already experiencing the effects of climate change through melting glaciers, increasingly frequent and intense storms, and disasters like landslides, floods and droughts. Vegetation patterns in the high Himalayas are altering, and the new plants and grasses emerging are not the favoured food of the herbivores. In addition, seasonal water availability for both humans as well as wildlife is changing because glaciers are melting earlier in the year.

WOW! FACT

The Snow Leopard (*Panthera uncia*) is a very shy predator of the Himalayan ranges, and therefore rare to sight in their natural habitat. It is a globally '**Endangered**' species and identified as the flagship species for the high-altitude Himalayas.

Source:

<https://www.discovery.com/nature/living-in-harmony-with-snow-leopards>

<https://www.conservationindia.org/case-studies/heights-of-success-snow-leopard-conservation-in-the-high-himalaya>

<https://www.downtoearth.org.in/interviews/climate-change/-one-snow-leopard-gets-killed-every-day--74625>

CASE STUDY 2: CONSERVATION OF GREAT INDIAN BUSTARD IN RAJASTHAN

Humans and wildlife often share habitat. The **GREAT INDIAN BUSTARD** (GIB) was once found commonly in the grassland landscape of Rajasthan and had peacefully coexisted with the local community. But the population in India dwindled from an estimated 1,260 in 1969 to around 150 today, of which around 122 are in Rajasthan, concentrated in the Jaisalmer district. Conversion of grasslands for farming or industrial projects, change of marginal farming to intensive farming and hunting are some of the factors responsible for the decline of this species.

When Desert National Park (DNP) in Rajasthan was proposed in 1981, local people from 70-75 villages feared being displaced from their homes. This led to considerable tension between the local community and the Forest Department. In addition, GIB were being hunted illegally for the consumption of its meat even after the formation of the National Park. This was done mostly by poachers or hunters who were from outside. This led to conflict between the forest department and locals.

A wildlife biologist couple in collaboration with the Forest Department initiated a community conservation project in 2015 where a batch of 25 youth from 10 villages closest to the DNP were trained as nature guides. Because of water scarcity agriculture is not a major livelihood option in this region. Most of the local people work as animal herders or have small businesses. Therefore, having an additional skill has helped local youth earn additional income. As word got out and these trained guides started getting enquiries from tourists, particularly to have a glimpse of the

WOW! FACT

The critically endangered Great Indian Bustard (*Ardeotis nigriceps*) is endemic to the Indian subcontinent and is among the heaviest of flying birds in existence. They have a slow birth rate. They lay one egg every year or two.

GIB, their confidence grew, and they developed a sense of ownership for the bird.

Some of these trained nature guides have influenced friends and acquaintances to get interested in wildlife, especially the GIB. Called the **Godawan Friends**, the network of nature guides not only support wildlife research, but also keep a watch out for poachers and tip off the forest department about any such attempts on any wildlife. The farmers in the GIB landscape are now being encouraged to switch to organic farming that is not just beneficial to them in the long-run but also to the environment.

→ **Additional threats:** India plans to expand its renewable power capacity nearly five-fold by 2030. The wide-open region that's home to the rare GIB has long been an ideal location for wind and solar energy projects. Incidents have been recorded of GIB colliding against power lines and dying. In an effort to save the GIB from flying into power lines, the Supreme Court has asked for transmission lines to be placed underground which the companies have objected to.



Photo: Prajwalkm via Wikimedia Commons

Great Indian Bustard *Ardeotis nigriceps*

Source:

<https://sustain.round.glass/conservation/great-indian-bustard-2/>

<https://thefederal.com/news/great-indian-bustard-and-grasslands-are-in-face-off-with-solar-parks/>

CASE STUDY 3: RESTORING THE MANGROVES IN SUNDARBANS

There are numerous species of mangroves in the forests of Sundarbans, West Bengal which have been the lifelines of local communities living around these forests for generations. But human development activities such as clearing of land for agriculture, timber and fuel wood collection, and pollution from economic activities including aquaculture have led to the degradation and loss of mangroves in the Sundarbans. Apart from acting as a barrier against cyclones, the mangroves are known to serve as breeding ground for fish, prawns and crabs. The loss of mangroves would have dramatic consequences for humans and nature alike.

The **SUNDARI TREE** is one of the most extensive species in the Sundarbans. Its hard wood is often used by fishermen to make their boats. Sundari trees, unlike other mangrove species, require low saline conditions for optimum growth and survival. Increasing salinity in the Sundarbans is leading to this mangrove species acquiring the “top-dying” disease.



Photo: Dhritiman Mukherjee

Sundari *Heritiera fomes*

WOW! FACT

The world's largest mangrove forest, the Sundarbans, is said to be named after the Sundari tree (*Heritiera fomes*) found in this delta. It bears small, bell-shaped flowers, which vary in colour from orange to pink. The species is already facing threat of extinction in West Bengal and is listed as “Endangered” on the IUCN's Red List.

About 18-20 women from the villages located on the Gosaba island in the Sundarbans who have lost their husbands to tiger attacks have come together to revive this vanishing species. They have created exclusive plantations of this mangrove species in vacant land outside their villages.

Their tree revival efforts kicked off in 2018 and they have already raised nearly 5,000 saplings and continue to grow more. The women began by scouting for these rare, hard to find seeds of the Sundari from riverbanks left behind by the ebbing tidal waters. These seeds were reared in the nursery and the saplings are planted along the embankment on the opposite side of the stream. Around 3 km of vacant stretches of land along the inner edges of village embankments are lined with the Sundari saplings.

→ **Additional threats:** People in the Sundarbans are now facing the consequences of climate change – recurring cyclones, erratic rain, rising heat, depleting mangroves and more. Five major rivers draining into the Bay of Bengal through the central Sundarbans have lost their upstream connection with the Ganga due to heavy siltation. The steady decline in the supply of freshwater and the rise of sea levels has increased salinity in the soil and water.

Source:

<https://sustain.round.glass/conservation/guardians-sundari-reviving-mangroves-sundarbans/>

CASE STUDY 4: GALATHEA BAY

Located at the south-eastern edge of the Bay of Bengal, the Andaman and Nicobar archipelago is made up of over 300 islands and separated from mainland India by about 1,200 km. Great Nicobar Island is the southernmost of these islands.

Galathea Bay located along the south-east coast of Great Nicobar is the most iconic nesting site in India of the enigmatic **GIANT LEATHERBACK** sea turtle. The bay is named after Galathea river which empties into the sea here and the extensive beach is regularly used by Leatherback, Olive Ridley and Hawksbill turtles for nesting. The Galathea Bay was declared a wildlife sanctuary in the late 1990s and is listed as one of the most 'Important Coastal and Marine Biodiversity Areas' and 'Important Marine Turtle Habitats' in India. The adjoining coastal forests are nesting grounds of the Nicobar Megapode, a bird species found only in the Nicobar Islands besides supporting a diverse range of biodiversity.

Galathea Bay was severely damaged by the 2004 tsunami, in which 90% of the mangrove forests were destroyed. Several rainforest trees were scorched due to excess salt that entered the soil. The beach across Galathea that had hosted Leatherback turtles for centuries was claimed by the sea.

However, a mishap led to unexpected consequences. The only bridge over the Galathea river that connected Campbell Bay (the main human settlement on Great Nicobar) to the sanctuary, snapped, cutting off all contact. The near-complete isolation provided the coast with a rare opportunity to recuperate. Mangrove seeds travelled through the waters to colonise the coasts. New beaches were formed slowly. Amidst ruins

WOW! FACT

Giant Leatherback (*Dermochelys coriacea*) is the world's largest, fastest and deepest-diving marine turtle. It has existed in its current form since the age of the dinosaurs.

Leatherbacks *Dermochelys coriacea* crawling to the sea



Photo: U.S. Fish and Wildlife Service Southeast Region via Wikimedia Commons

and around ghost trees, a forest regrew. Today, the number of leatherback nests is almost comparable to what Galathea Bay Wildlife Sanctuary hosted before the tsunami dealt its blow — a warm reminder that if nature is left alone, it will find a way to recover.

→ **Additional threats:** In January 2021 Galathea Bay was denotified as a wildlife sanctuary for the construction of a transshipment port. An ambitious development plan by the Indian government that includes an airport, a port, a rapid transport system, and a trade complex is set to change this landscape. The mega project will also affect Great Nicobar's original human community – the Shompen – who are hunter-gatherers and use this area as foraging grounds.

Source:

<https://www.conservationindia.org/campaigns/proposed-development-tsunami-will-engulf-great-nicobar-islands>

<https://sustain.round.glass/habitat/galathea/>

CASE STUDY 5: AAREY A UNIQUE URBAN FOREST, MUMBAI

Aarey colony, located to the south of Mumbai's Sanjay Gandhi National Park, is a forest of about 1,300-hectares. Described as Mumbai's last remaining "green lung" it is a treasure trove of birds, butterflies, amphibians, reptiles and mammals, among them the leopard. It is also home to the Warli tribal community who have been living here for generations.

In 2019, the municipal corporation's Tree Authority committee approved a proposal to cut down 2,702 trees in Aarey colony to build a car shed for the Mumbai Metro 3 line. This enraged environment and citizens' groups who had been organising "Save Aarey" protest rallies against the car shed since it was first proposed in 2014. This time, however, their calls to citizens to attend protest meets were answered with an unusual enthusiasm.

For several weeks thousands of concerned citizens showed up near the proposed car shed site with placards and posters and formed a human chain along with Warli tribals from Aarey colony. The protest received support from across sections, especially the young crowd. Many young protesters attending Aarey rallies were driven by concern for the global



Photo: Ramya Nair / Project Waghoba

Warli art on the wall of a shrine in Sanjay Gandhi National Park, Mumbai.

climate change crisis influenced by climate activist **Greta Thunberg**.

The campaign succeeded in convincing the Maharashtra Government to shift the metro car shed out of Aarey. The government also declared 600 acres of land as forest. This decision also protects the rights of tribals in Aarey.

The success of "Save Aarey", one of the prominent environmental campaigns in urban India in recent times lay in the fact that it was an innovative protest movement. The supporters of the movement used all possible mediums to spread their message and concerns effectively. They also successfully linked the larger topic of need to protect the environment against the rampant concretisation of urban areas.

→ **Additional threats:** In recent years there has been a big rise in encroachments. Developmental activities and infrastructure projects are eating into the forest area. All this has squeezed the leopards' hunting area. This encroachment of the city into the park has led to conflict with humans thus threatening Mumbai's leopard population. The future of these big cats will now depend on how people living near the park deal with their presence around them.

In several Indian cities, apart from forest areas numerous wetlands that are home to a variety of wildlife too are threatened by development.

WOW! FACT

Waghoba (a combination of the Marathi words for big cat and community elder) is a large cat deity that is worshipped by many forest tribes in Central & Western India. Warli tribes in Maharashtra consider the leopard or Waghdev as their deity whom they pray to first on all auspicious occasions.

Source:

<https://scroll.in/article/937002/saving-aarey-why-a-city-with-a-weak-protest-culture-is-demonstrating-to-protect-mumbais-green-lung>

<https://www.newsclick.in/Save-Aarey-Success-Effective-Media-Campaign-People-Involvement>

<http://aareyconservationgroup.org/save-aarey-movement/>

www.hindustantimes.com/mumbai-news/how-some-mumbai-hamlets-live-dangerously-close-to-leopards/story-Q2C4REMAF4fk4MXq93YrAl.html

PART A: UNDERSTANDING BIODIVERSITY IN OUR ENVIRONMENT (ELECTIVES)

PICK ANY 2 OF THE 4

1. Wild Edible Plants (WEP) Garden
2. Biodiversity Wall Mural
3. Habitat for Insects
4. Pond Ecosystem



1: WILD EDIBLE PLANTS (WEP) GARDEN

Wild Edible Plants (WEP) are plants that can be consumed but are not cultivated by humans. They grow naturally in the forest, agricultural lands, fallow lands, on the roadside, empty sites, in and around wetlands, etc. WEP provide essential nutrients but their use in our diet has been declining due to change in food habits, lifestyle and changes taking place in the landscape.

Much of the food we eat travels long distances to arrive on our plates. Transportation not only uses petroleum-based fuels but also contributes to climate change through emissions of CO₂ into the atmosphere. Implementing a WEP garden at your school, which you can also eat from, is one of the best ways to take action to help the environment and cut down on your contribution to climate change. So much of the food we eat travels long distances to arrive on our plates.

OBJECTIVES

- To explore, identify and document WEP resources and traditional knowledge associated with these plants.
- To understand to what extent WEP are currently used in the diet of local people and if there is any dietary shift.
- To facilitate cooperation between students and teachers, and other members in the school.
- To enhance the nutritional intake of students who eat from the garden.





STEP 1: DATA COLLECTION

Speak to elderly family members, neighbours, and schoolmates and gather information about WEP that they have consumed. If the person you speak to is aware of any dish that can be prepared using the WEP take down the recipe.



STEP 2: SETTING UP THE GARDEN

Discuss with the person in charge of the garden or the kitchen in your school about starting a kitchen garden of WEP. With the help of your teacher and the person-in-charge shortlist a few WEP from the list you have gathered that can be grown in the school. Source seeds or saplings of the selected WEP from their natural habitat (some plants may be right in your backyard) and start a kitchen garden with the help of your teachers and school staff.

If your school does not have an outdoor space, grow the WEP in containers.

- 
1. Local name of the plant.
 2. Which part of the plant is consumed?
 3. Where does it grow?
 4. In which season does it grow?
 5. How often was it consumed?
 6. Is the plant currently available?
 7. Wild Edible Plant recipe

Put together an illustrated booklet of WEP recipes from the information gathered (optional)

Assign yourself a book to note down observations of your WEP garden.

STEP 3: MONITORING

Notice their growth, the kind of flowers they produce, the pollinators that visit the plants, type of seeds produced and how they are dispersed and other information. Also note which other animals consume the WEP. Document your observations through sketches and notes. Encourage other students and staff in the school to observe and monitor the WEP garden.

Like humans, plants are evolved to survive and reproduce. Since they lack fangs and claws, and don't have legs to flee, plants produce chemical defences to protect themselves against being eaten. Many of the chemicals plants produce are harmful to us humans too. Do not attempt consuming any wild plant without the guidance of an adult who has sufficient knowledge about the plant.

If your school has a kitchen, get the kitchen staff to prepare dishes using WEP. If not, you could donate the plants to another school in your neighbourhood for their consumption.



Mark with a name tag

REFLECTION

- Of the total number of people you spoke to, how many were aware of WEP?
- Did you find any difference between those who knew about WEP and those who didn't -- perhaps based on gender, age, social class?
- Amongst the people you spoke to, if someone had never consumed WEP, what could be the reason?
- How many types of WEP were you able to document through this activity?
- How easy or difficult was it to source the plants to set up the WEP Garden in the school?
- Did you document any WEP that does not exist in your area anymore? If yes, what could be the reason for the decline or vanishing of this species from the area?

WOW! FACT

We know of several species of plants that can be consumed by us and other animals. But do you know that plants can eat animals too?

Commonly known as Sundew, *Drosera* is a sticky, fly trapping carnivorous plant that bears long tentacles on its leaves which glisten like dew in the sun. As soon as an insect lands on these leaves, it sticks to them and the leaves coil around their prey to slowly digest it.



2: BIODIVERSITY WALL MURAL

A mural is a piece of artwork painted or applied directly on a wall, ceiling or other permanent substrate.

OBJECTIVES

- To paint a wall mural which helps learn a skill using locally available natural material.
- To understand and appreciate folk and community art as well as local flora and fauna.
- To explore the types of soil around you.
- To facilitate cooperation between students, teachers, and other school members.



STEP 1: PREPARING THE DESIGN

- Based on activity 1 and activity 2 choose a few plant and animal species seen in your surroundings that you would like to depict on the wall.
- On a large sheet of paper create a **composition** (arrangement of the visual elements) by drawing the outline of animals and plants you have chosen. You can include decorative elements too in your composition.
- If you are confident about drawing directly on the wall you could do so. If not, draw each of the animals and plants on a large scale on separate sheets of paper. Cut the outline and use it as a stencil to trace the drawing on the wall.

STEP 2: PREPARING THE WALL

- Choose a wall (indoors or outdoors) which is sheltered from rain.
- Clean and wash the wall, using brush and water to remove dust and dirt.
- Apply a layer of cow dung, mud plaster or lime to form a base layer of uniform colour. Apply this to the cleaned wall using a roller, big brush or a piece of cloth, and wait for it to dry.

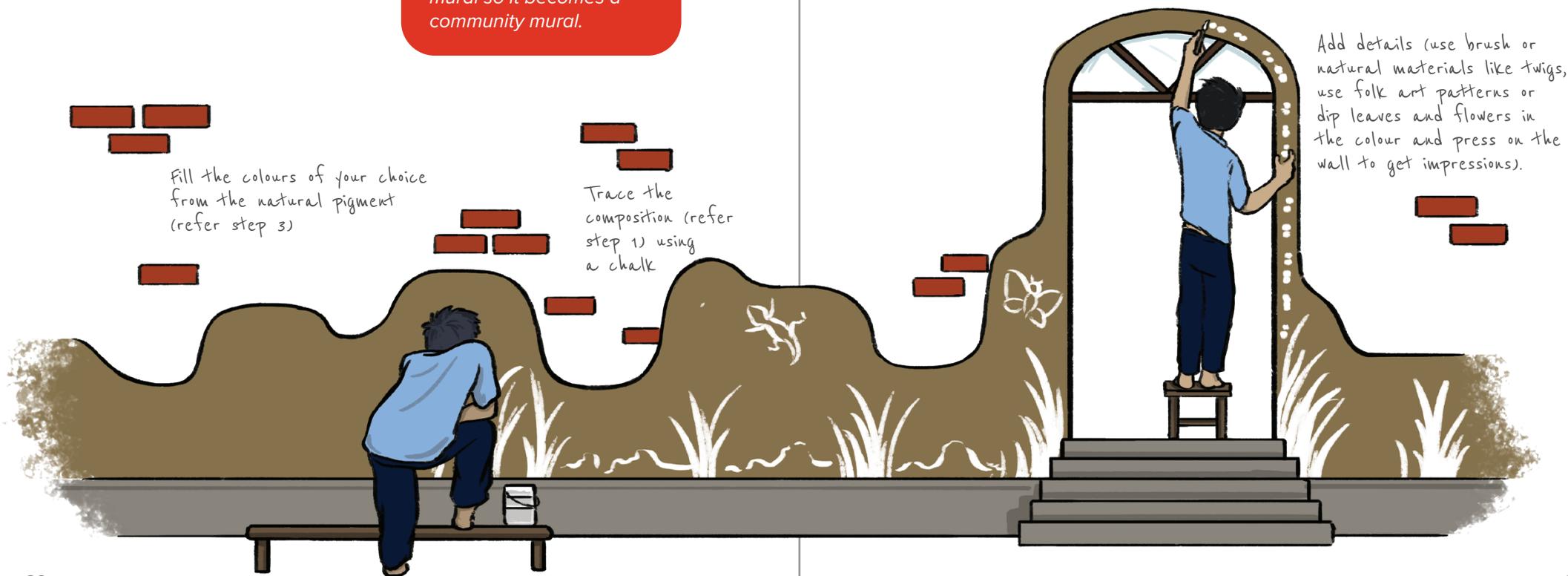
STEP 3: PREPARING THE COLOUR

- Collect different types of soil in and around the school.
- Sieve the soil to get very fine powder.
- Mix this fine powder with varying amounts of water to prepare the colour. Soils differ in their colour, texture, particle size, viscosity, and composition, depending on the location, climate, and terrain.

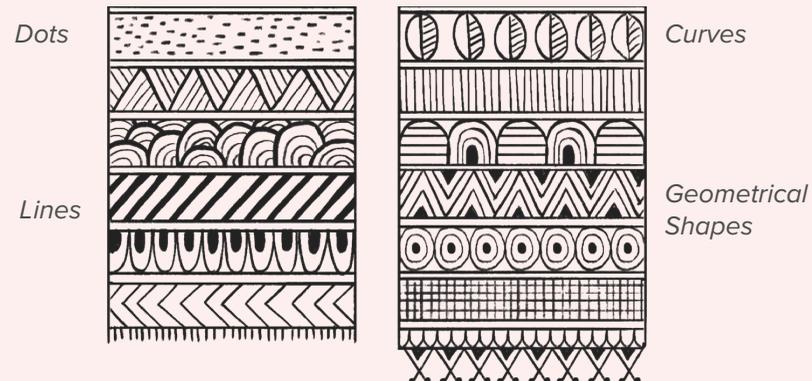
If you have access to any resin locally like Gum Arabic, Gum Karaya mix it with the soil as it acts as a binding agent.

STEP 4: CREATING THE MURAL

Involve as many students and other school members as possible to paint the mural so it becomes a community mural.



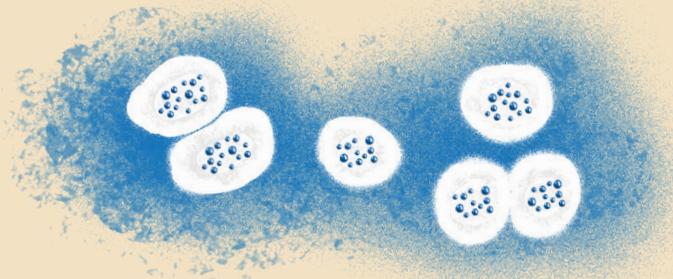
Folk-art patterns



REFLECTION

- How many types of soil did you collect to paint the mural?
- What kind of plants were growing on these different kinds of soil?
- Did you collect the topsoil, or did you have to dig deeper?
- Which type of soil was easy to use as a colouring pigment?
- How easy or difficult was it to work as a team to create the mural?
- Did the process of painting the mural give rise to any interesting questions or discussions among your schoolmates and teachers?

WOW! FACT



PETRICHOR

What do you smell when it rains after a warm, dry period? Petrichor - an earthy, usually pleasant odour.

Actually what you consider to be the smell of damp earth is actually produced by a molecule made by a certain type of bacteria. That molecule geosmin is produced by microscopic *Streptomyces* bacteria present in most healthy soils. Drops of water hitting the ground cause geosmin to be released into the air, making it much more abundant after a rain shower. The next time it rains, step outside and smell the petrichor.

3: HABITAT FOR INSECTS

Insects are often considered troublesome. On the contrary they are distinctly helpful – from pollinating bees to aphid-eating lady birds, lacewings and hoverflies, the army of waste consuming beetles, plus a whole host of others working away unseen by the human eye. Insects are not merely mostly harmless or even useful members of the animal kingdom, but they are well worthy of close attention in their own right.

Insect groups such as butterflies which are often large and colourful spreading their lovely wings over bright flowers receive a lot of admiration. There are a lot of insects out there that aren't as pretty as the butterflies, but if you look into their world, they can be equally fascinating.

OBJECTIVES

- To provide the right habitat for insects, both diurnal and nocturnal so we can greatly increase the number of beneficial insects around us.
- To learn something of the ways of insects, to look beyond the obvious and get down to their level to know them in all their stages, in their natural and less natural habitats.
- To cultivate a deeper understanding and appreciation of insects as fascinating and wonderful animals.

Join two coconut shells, drill holes and hang them for insects!





3.1 BUILDING A HOME FOR INSECTS

You can get creative with building insect homes, as there are no set rules.

What you need

Recyclable stuff: Broken bricks and tiles, stone chippings, broken plant pots, corrugated cardboard, broken PVC pipes



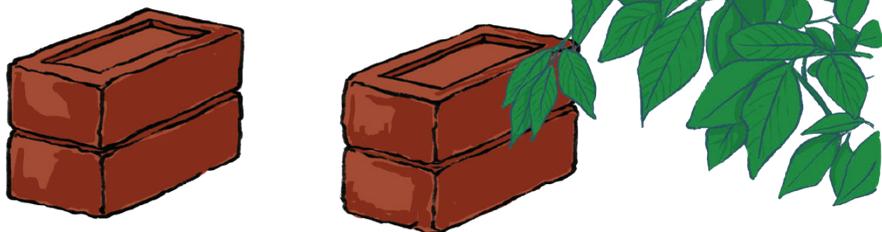
Natural materials: Dead wood, dry leaves, loose bark, hollow plant stems such as old bamboo canes, or holes drilled into blocks of wood. Drilled holes should be at least 6 inches long (15 cm.)

Where to build

Choose an even surface where you get good sunlight as well as shade. Some invertebrates like cool, damp conditions, while others prefer the sun.

School with garden space: Build closer to shrubs and bushes

School without garden space: Build in the terrace or balcony



How to build

- 1 Start by laying some bricks on the ground as sturdy corners
- 2 Leave some spaces in between the bricks for creatures to move in
- 3 Place a few wooden planks or logs on top of your bricks.
- 4 Fill in the gaps (leaf litter, straw, stack of sticks, bamboo, logs with holes and other materials)
- 5 Add a roof to ward off the rain and sun

Provide all sorts of different nooks, crevices, tunnels for the insects to feel safe.

3.2 DEVELOPING A GARDEN FOR INSECTS

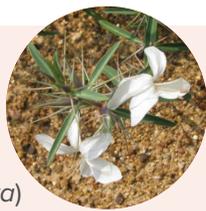
Plants provide habitat for insects to feed on, lay their eggs and pupate.

Create an insect garden by planting herbs, shrubs and climbers that attract insects, either in pots or on the ground around the insect home. Try to grow as many local and wild varieties of plants as possible. Source them from your backyard, an empty plot, or anywhere plants grow wild. This gives you an opportunity to observe which plant attracts what kind of insects. Avoid any form of chemical fertilizer or pesticides for your plants, instead use organic manure.



Plants for your insect garden

- Butterfly Bean (*Clitoria ternatea*)
- Common Chaste tree (*Vitex negundo*)
- Common cough Cure (*Adatoda zeylanica*)
- Crape jasmine (*Tabernaemontana divaricata*)
- Curry leaf (*Murraya koenigii*)
- Giant Milkweed (*Calotropis gigantea/procera*)
- Impatiens
- Indian Pavetta (*Pavetta indica*)
- Indian Shot (*Canna indica*)
- Indian Turnsole (*Heliotropium indicum*)
- Ixora
- Lemon (*Citrus limon*)
- Oriental sesame (*Sesamum orientale*)
- Panacea Twiner (*Tylophora indica*)
- Rattle pod (*Crotalaria* species)
- Rosy milkweed Twiner (*Oxystelma secamone*)
- Silky Elephant Glory (*Argyreia nervosa*)
- Thunbergia species



Barleria



Mustard



Tanner's Cassia



Silver spiked cockscomb



Common Leucas



Rot Cassia

Wait and watch

As and when you visit the insect habitat, make observations of the home as well as the garden and fill in your insect journal. Look closely for eggs, larvae, and adult insects during your observation period. Note down the following information at the insect home-



Date & Time:
 Duration of observation:
 Weather:
 Description of the insect (physical features)
 Sketch of the insect
 Behaviour of the insect
 Number of individuals spotted
 Type of hole or burrow, and material the insect was using to hide or nest

Assign yourself a book (insect journal) to write down your observations



Similarly note down observation of the plants in the insect garden

Name of the plant
 Is the plant fruiting or flowering?
 Is the plant used by insects for feeding, laying eggs, pupating, nesting or collecting nesting material?
 Did you notice insects on the flowers? What colour, shape and size was the flower and what type of insect was using the flower?

Taking care of your insect habitat: Keep your insect garden healthy. Make sure plants are not dry or wilting. Water them daily or on alternate days, as they require. Observe pupae and caterpillars without touching and leave them as they are and where they are. Other than insects if you find other creatures like spiders, millipedes, amphibians using the habitat observe them too. Encourage your friends at school to make observations. **Avoid handling and harming any creature that you notice in the habitat.**

REFLECTION

- What kind of materials did you think would be useful to build the insect home? Which material did you use for the construction of the insect home?
- What kind of discarded materials got recycled while constructing the insect home?
- Did you come across any insect or invertebrate while sourcing the materials (natural or human-made) to build the insect home?
- Did any of the wild insect homes you saw around inspire the design of the insect home you built? If yes, tell us which one.
- How many species of wild plants did you grow in your insect garden? List them.
- Where did you source your plants from? Did you notice any insects already present in these plants?
- How did the school community react (students, teachers and other staff members) after setting up the insect habitat?

WOW! FACT

The **Orthoptera** (order of insects that includes grasshoppers, locusts, crickets, katydids, and their relatives) are true musicians of the insect world and their music is produced as precisely as that of the human string player.

Grasshoppers produce their songs by rubbing the upper (thigh) part of their long hind legs against a hardened vein on their wing-covers; usually the two legs work in unison or one after the other.

Crickets on the other hand rubs one wing cover against the other overlapping wing. **Male Cicadas** sing by means of a pair of special membranes or tymbals situated at the sides of the abdomen (near the thorax) and beneath the wings.

INSECT MUSICIANS



4: POND ECOSYSTEM

Ponds are rich ecosystems. Even a small pond can be home to an interesting range of wildlife such as dragonflies, damselflies, frogs, beetles and fishes. Birds visit them to drink water and bathe. Adding a pond is one of the best things you can do for wildlife in your school yard.

OBJECTIVES

- To create a mini pond using locally available materials.
- To explore the diversity of life associated with a pond ecosystem.
- To develop an appreciation for wetland ecosystems and understand the services provided by them.
- To facilitate cooperation between students and teachers, and other members in the school.



WHAT YOU NEED

Mini ponds can be constructed from a whole range of containers with wide necks so wildlife can go in and out. Be creative and look for containers that you can upcycle – Disused wheelbarrow, bathtub, wash basin, washing bowl, sink, recycled tyre tube, metal tub, etc Or buy a wide mouthed plant pot (cement) from a plant nursery.

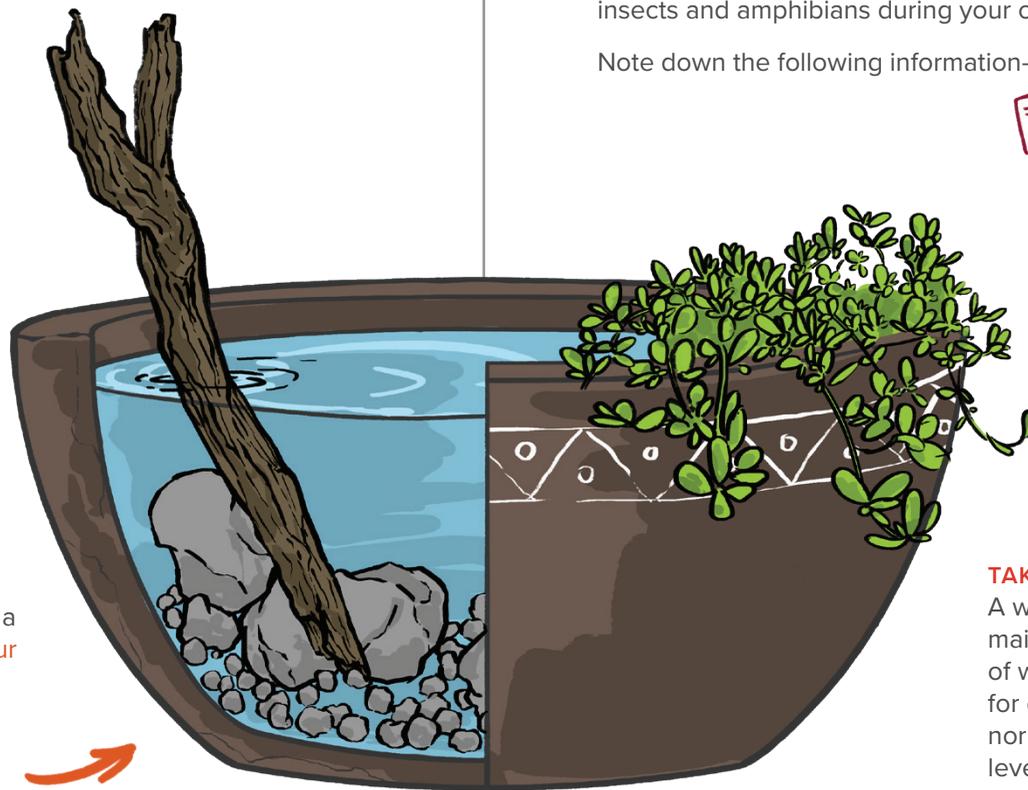
Natural materials: Old bricks, rocks, stones, gravel and sand, dead wood, branch, sand, PVC pond liner (optional)

WHERE TO BUILD

Choose a spot in the school ground, terrace, or balcony. Your pond will want light, but not full sunlight all day.

HOW TO BUILD

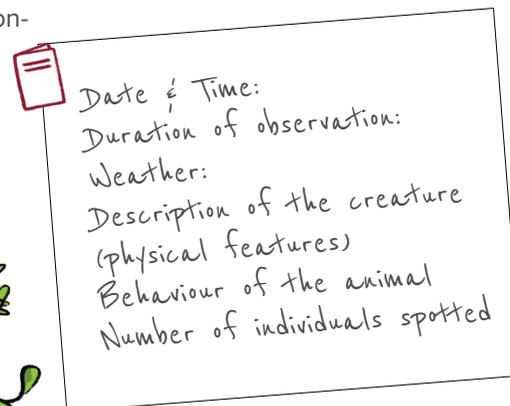
- 1 Dig a hole and sink your container, or just have it sitting on top. If the container isn't waterproof then add a piece of pond liner.
- 2 Add a layer of gravel, rocks, and sand. Use stones to create a range of depths and a slope for creatures to climb in and out. If your container is not sunk into the ground, use branches to make a ramp from the ground outside for animals like frogs and toads that cannot fly.
- 3 Fill your pond with water. Use collected rainwater if possible to fill your pond as treated tap water contains chemicals.
- 4 Adding plants: Plants are an important part of the pond as they add oxygen to the water and provide food and shelter for wildlife. Plant aquatic plants in small pots or containers and place them inside the pond or if planting directly, fix them into the gravel and sand at the bottom of the pond. Place small stones to stabilise tall plants without damaging them.



WAIT AND WATCH

The wildlife will come to your pond on its own. Keep a record of what you see and write about it as often as possible. Look for the eggs and larvae of insects and amphibians during your observation time.

Note down the following information-



TAKING CARE OF YOUR POND

A well-chosen set of plants and a well-maintained pond should not need a lot of work. However, do keep an eye out for dead organic matter. Evaporation is normal during the summer but if the water level drops, use rainwater to fill it back up again. Remove any excess of leaves from the pond, especially in the winter, to allow enough light. Cut back plants that are growing quickly.

Assign yourself a book or journal to keep track of the pond ecosystem.

Do not pick up animals from natural ponds or lakes to introduce them here

Wildlife requires places to hide and shelter. If your school has a large campus, it will be good to place the pond near a grassy patch. If the pond is on a terrace or balcony, place a few potted plants around the pond.



Plants for your Pond

You will need 3 types of aquatic plants – Submerged, Floating and Emergent plants. Try to source the plants from a local water body with the help of your teacher.

Submerged plants:

- *Hydrilla verticillata*
- *Potamogeton crispus*

Floating plants:

- Crested Snowflakes
Nymphoides hydrophylla
- Broad-leaved Pondweed
Potamogeton natans
- Watercress
Nasturtium officinale (edible)

- Mosquito Fern *Azolla pinnata* (Good for mosquito control but this fern needs to be harvested regularly. Use it as a biofertilizer for plants in your school garden as it is rich in nitrogen).

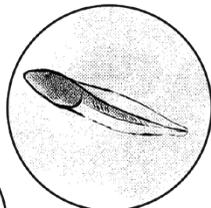
Emergent plants:

- Purple Nutsedge *Cyperus rotundus*
- *Scirpus articulatus*
- Bearded Marsh-star
Dysophylla stellata
- Common Marsh Buckwheat
Polygonum glabrum
- Indian Marshweed
Limnophila indica
- Water Hyssop
Bacopa Monnieri (edible)
- Variegated Water Celery
Oenanthe javanica (edible)

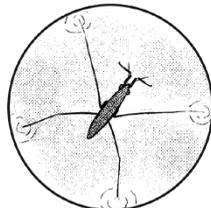
Wildlife that you may come across in and around the mini pond



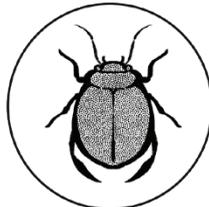
Toad & Frog



Tadpole



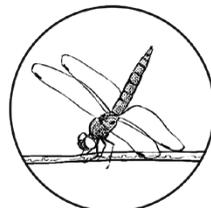
Pond Skater



Diving Beetle



May fly



Dragonfly & Damselfly



REFLECTION

- Where did you set up the pond in your school and why did you choose this spot?
- How or where did you source the container and natural materials for your pond?
- Where did you source the aquatic plants for the mini pond? List the species planted in the pond.
- What did you learn about conditions necessary for supporting life in a pond?
- What was the reaction of the school community (students, teachers and other staff members) after setting up the pond?

WOW! FACT

Invasive Alien Species (IAS) are species that have been introduced, either naturally, accidentally or intentionally, into an environment that is not their own. After a certain amount of time, they adapt to their new environment and begin to colonise it.

IAS cause loss of biodiversity as they hinder the growth of native species and alter habitats, cause physical and chemical changes to the soil, compete for food and space, and introduce new parasites and diseases.

While aquatic plant species like Water Hyacinth (*Eichhornia crassipes*) and Water lettuce (*Pistia stratiotes*) are used in aquariums and human-made ponds these are alien invasive species and must be avoided.



WATER HYACINTH

PART B: ECOLOGICAL HISTORY: PAST, PRESENT AND FUTURE (COMPULSORY)

(Activities in this section have to be undertaken after the completion of all the compulsory activities in PART A)

1. Historical Timeline
2. Seasonal Calendar
3. A Vision for the Future: Rich Picture



ECOLOGICAL HISTORY: PAST, PRESENT AND FUTURE

→ People make choices based on their knowledge about the local environment in their region. Part of this knowledge includes an understanding of natural cycles in the environment, such as weather, phenology and migration, as well as an understanding of the history of land use and natural as well as human caused events that have led to what we see today. Besides this oral history, people may also see trends in their environment and have an idea of where things are going and what they expect to happen in the future. Understanding of the past and expectations for the future can have powerful effects on current behaviour.

Phenology is the study of the timing of seasonal biological events, such as the flowering of plants or the migration of birds. For example, you are observing phenology if you note when your favorite plant begins to flower or fruit each year.

In this section you will collect and compile local knowledge of change and how you oversee your future using a seasonal map, a historical timelines and draw up a rich vision for the future.



OBJECTIVES

- To capture the chronology of ecological events and historical landmarks as recalled by local people.
- To investigate local knowledge of processes of environmental change occurring in the region.
- To learn how changes in the environment have influenced the community and their relationship to the local biodiversity.
- To produce a shared vision for the area



Information required to undertake the activities can be obtained from Part A activities, library, online search as well as talking to a new set of people including your family members, neighbours, school members and others.

1: HISTORICAL TIMELINE

A historical timelines activity is used to generate historical information and document significant events and changing conditions in the environment through pictures, written format or both. This activity helps understand what the local people consider important in the ecological history of their landscape and how they dealt with problems and issues in the past. It also helps gain insights on the present practices and attitude of the community.



Chart paper, scale (ruler), marker pens or sketch pens

STEP 1:

Construct a table as shown below to collect data

Time period	Landscape level change/ event	Effect on wild plants & animals	Effects on the people
At present			
20 years ago			
40 years ago			
60 years ago			
20 years from now			

STEP 2:

Gather information from individuals or groups and fill in the table. Depending on the age group of the person you are speaking to, ask her/ him to recollect how the area or locality or village was about 20 years ago, and then 40 years ago. If you are talking to elderly people older than 60 you can ask them to describe the area when they were children.

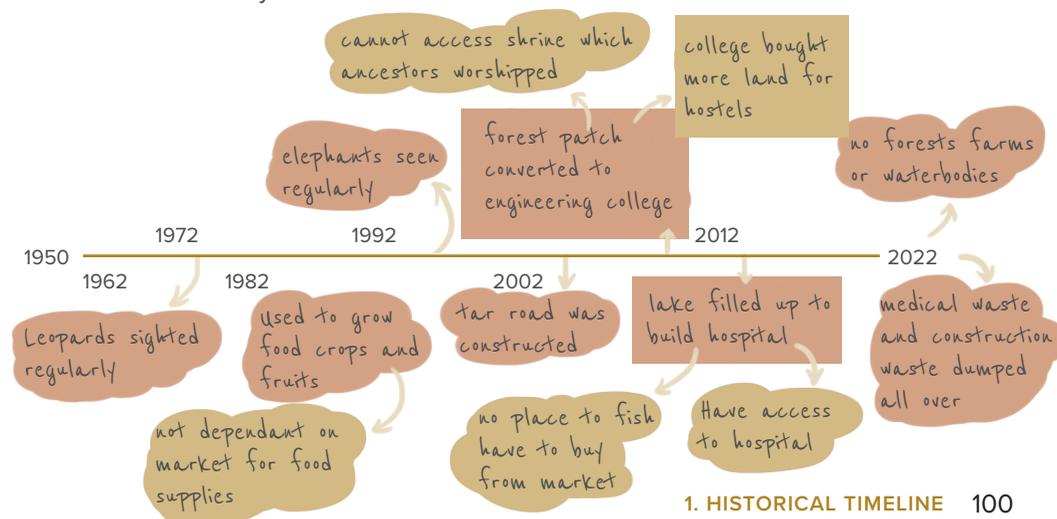
- Note what kind of changes took place in the landscape and why did these changes happen? Example: Was a forest or grassland patch cleared to set up an industry or to build a road?
- What kind of effect did the changes in the landscape have on local ecosystems and wild animals and plants living in these ecosystems?
- How did it change people's lives?
- How would you like your area to be/look like in 20 years from now? What are the components you wish to see in your area? (This information will also be useful for the 'Vision for the future' activity).

Often people may not remember the exact year an event took place, so you must find ways to help them to pin it down in history. This is done by referring to more widely known events or circumstances such as political changes, natural disasters, and so on.

STEP 3:

Using the information you have gathered create a flowchart of the **Historical Timeline**

- Take a large chart paper and draw a horizontal line in the center. Divide this line to mark the dates (time period) from the past to the present.
- Write down the events that occurred during each time period in the space immediately above and below the line.
- Use additional space to write down the effects these events have had on the local ecosystems and communities.



FUN ACTIVITY

Mapping Green infrastructure

If you have access to computers with internet access (preferably high speed)



- Download **Google Earth** from earth.google.com
- In the search bar type the name of your locality or area.
- In the list of icons click on the 'clock' icon which will open a time slider. Place the slider for the current year and observe the map. Make note of parks, forested areas, grasslands, wetlands, open spaces and any other kind of natural areas. Observe how much greenery exists against developed areas.
- Now slide left to take a look at historical imagery of the same area at 10-year intervals (before 10 years, and then before 20 years). Make comparisons. Google images starting from the year 2000 will show you fine imagery that you can zoom into to see details.

How has your community changed in the last 10 and 20 years? What is similar and what is different?

2: SEASONAL MAP

Seasons are an integral part of biodiversity. Seasonal maps help explore what happens during the year and when. They reflect the perception of the local people regarding seasonal variations on a wide range of items.



Chart paper, scale, compass to draw circles, colours, glue

STEP 1:

- Construct a table of seven columns and at least five rows.
- In the cells in the first column, list the themes and categories you wish to gather seasonal information for, such as weather (rain, temperature), flowering and fruiting of local trees, wildlife sightings, wild edibles consumed, etc.
- In the cells across the top row of the next six columns, write the names of the seasons as they are known locally.

STEP 2:

Gather information from individuals or groups: Starting at the beginning of the year, for each theme or category, ask respondents a list of questions that helps you gather information about local biodiversity based on the seasons of occurrence. Examples of questions are given below.

(Ask several key informants when the year begins; it may be at the beginning of the rains, or for many farmers the harvest festival signals the end of one year and the beginning of another).



Seasons (English calendar)	Spring	Summer	Monsoon		Autumn	Pre-Winter	Winter
Seasons (Hindu calendar)	Vasant	Grishma	Varsha		Sharad	Hemant	Shishir
Weather							
Flowering tree species							
Fruiting tree species							
Wild edibles consumed							
Wildlife sightings							

Respondents may not be able to provide information for all the seasons and all the categories. Collecting information from several respondents will help you compile the information for the entire year. In addition, the observations made by you in the first two activities of Part A section of this booklet will also provide you with primary data.



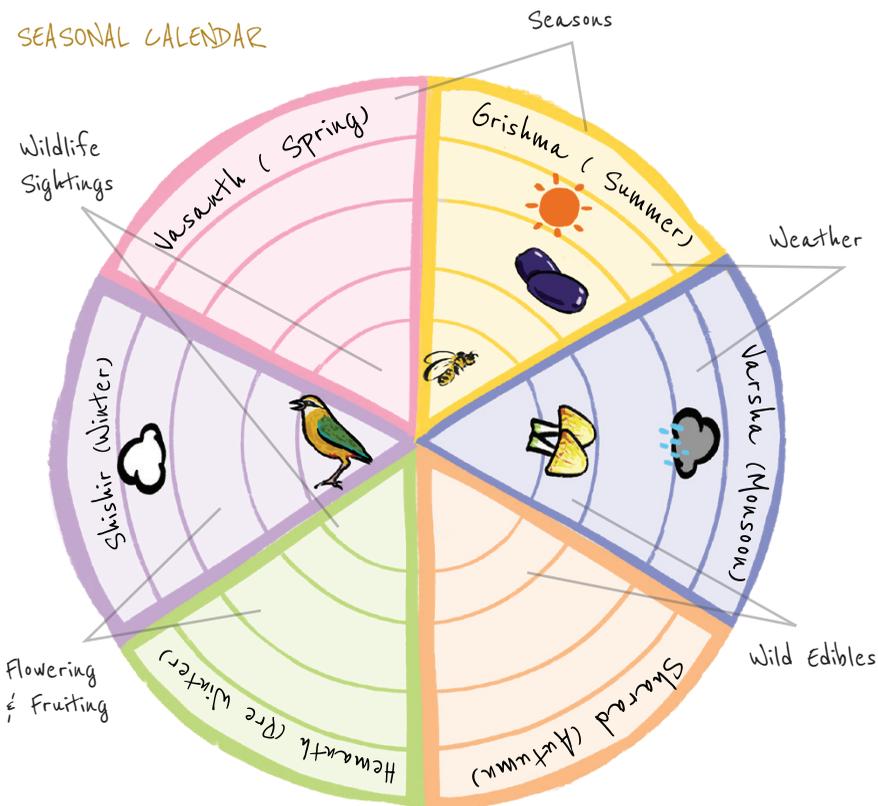
Guiding questions-

- Name a few local trees you are familiar with. In which seasons do they produce fruits and flowers?
- Do you see wild animals (butterflies, bees, grasshoppers, beetles, birds, spiders, rodents, snakes, fishes, etc) in large numbers in any of the seasons? Please give details (Do they breed or migrate during this season?)
- Do you consume wild plants and during which seasons are they available?

STEP 3:

Create an illustrated seasonal calendar (refer page 104) as per the instructions below.

- Draw concentric circles on a chart paper based on the number of themes you want to show.
- Divide the whole circle into six seasons and write their names.
- Divide each of the inner circles into 6 parts. Use each of the inner circles for different themes - fruiting and flowering trees, wild edibles consumed, wildlife sighted, etc. Draw the plant or animal species that occur in different seasons. You could also replace the plant drawings by sticking a part of the plant.



3: A VISION FOR THE FUTURE: RICH PICTURE

This activity involves developing a shared vision of how students would like their area to be/look like at some future time. This is done through a rich picture which helps us see relationships and connections that we may otherwise miss. Developing a rich picture is a good group exercise as all students can add to it and use it to explain their particular interests or perspectives. **A rich picture is best developed in a group of about 4 - 5 people.**



Chart paper, marker pens or sketch pens

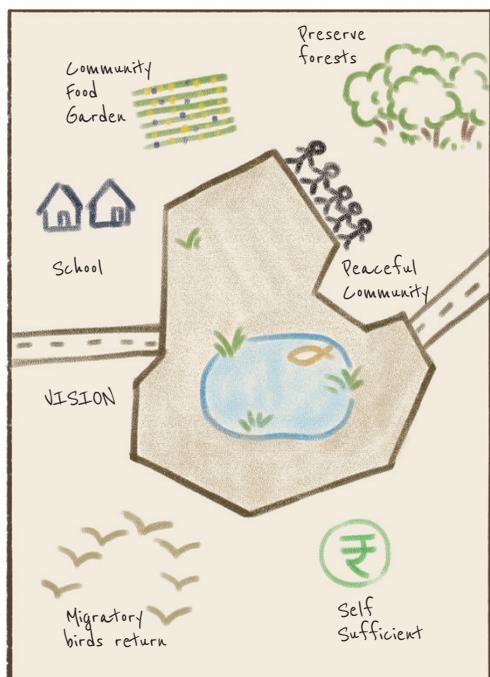
STEP 1: DISCUSS YOUR VISION

Based on all the activities you have done so far and the knowledge you have gained by talking to people in your landscape, think of how you would want your area to look in 20 years from now. What are the changes you would like to see? Focus on components you want to include in an ideal world that would promote a good quality of life. Also think of the components people from your area (those you spoke to) wanted to see.

STEP 2: DRAW THE RICH PICTURE

- Take a large piece of chart paper and place it on the table. Each student must stand in such a way that he/she can easily draw on the paper. All students should have a marking pen.
- Draw all the components that you might want in your area on the chart paper. Be creative, and constructive. Use pictures, text, symbols and icons to graphically illustrate how you would like to see your area.

It is everybody's duty to take care that everybody draws!



Display the **Seasonal calendar**, **Historical timeline** and **Rich picture** at your school and make a presentation for your school members. Get comments and feedback from the school community. Make sure all the team members get equal opportunity to present and answer questions.

REFLECTION

- How many respondents were aware of the seasonal changes?
- Have there been any drastic changes to the seasons and the events associated with seasons over the years?
- Is your community different today from when you were younger? What changes have you observed in the landscape where you live (consider roads, playing fields, open spaces, natural areas, housing developments and other components).
- How green is your community? Where can you go play or watch birds?
- Are there any natural spaces kept aside for religious, spiritual or aesthetic purposes? Is there a difference in the kind of interaction people from different age groups have with these spaces?
- If there are green spaces are they well connected? For example could a local wildlife species move from one green space to the next?
- What steps are necessary to implement your vision? Who might support your plan or oppose it?

! Prepare a project report compiling all the information from Historical timeline, Seasonal calendar and Rich picture activities. (refer page 17-18 on how to prepare a project report)

Submit a video clip of the presentation.



BIODIVERSITY PROGRAM COMPLETION CHECKLIST

At the end of your project, please tick the boxes for completed activities to ensure that you have not missed any. This will also help in the evaluation process.

PART A : UNDERSTANDING BIODIVERSITY IN OUR ENVIRONMENT

Compulsory Activities

- A1: Environment as a Shared Space
- A2: Species Diversity in Our Backyard
- A3: Biodiversity and Us (Game)
- A4: Biodiversity, Food, Livelihood and Climate (Interviews)
- A5: Biodiversity Threats and Conservation (Case Studies)

Elective Activities (Choose any 2)

- 1: Wild Edible Plants (WEP) Garden
- 2: Biodiversity Wall Mural
- 3: Habitat for Insects
- 4: Pond Ecosystem

PART B : ECOLOGICAL HISTORY - PAST, PRESENT AND FUTURE

Compulsory Activities

- 1: Historical Timeline
- 2: Seasonal Calendar
- 3: A Vision for the Future: Rich Picture

THANK YOU FOR PARTICIPATING IN EARTHIAN!

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