

# ECO-CLUB MANUAL

## (FOR ECO-CLUB INCHARGES)

2012



स्वाध्यायान्मा प्रमदः

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## CHAPTER

# 2

## Biodiversity

### Introduction

The variety of life present on Earth is commonly referred to as biodiversity. The number of species of plants, animals, and microorganisms, the enormous diversity of genes in these species, the different ecosystems on the planet, such as deserts, rainforests and coral reefs are all part of a biologically diverse Earth and represent its rich biodiversity. The earth supports an incredible array of biodiversity—from micro-organisms to the ocean's great blue whale—with plants and animals of all shapes and sizes in between. India is a biodiversity hot spot. The diversity of organisms could be seen as species diversity when we take into account the number of variety of individual species or taxonomic diversity i.e., number of variety of major groups of organisms. The richness of an area reflected in the terms of various life forms is good for the sustainable development. Monoculture, that is a single species dominated area have an adverse impact on the biodiversity of an area.

The main focus of the biodiversity education is to create knowledge, interest and necessary skills to solve various biodiversity problems.

Key words: biodiversity, ecosystem, hotspot, taxonomy, monoculture

### About the topic

#### Why is Biodiversity important?

Biodiversity is essential to every aspect of the way that humans live around the world. Plants and animals provide people valuable services in the form of food and medicine, trees play an important role in absorbing green house gases, through photosynthesis trees absorb and store atmospheric carbon, helping to combat global warming and purifying the air we breathe. Forests also control soil erosion

and clean the air we breathe.

The various life forms present around us are serving various ecological roles and we all are interconnected via **food chain**, representing different trophic levels. A food chain is a sequence of who eats whom. The usual order of a food chain is sunlight, plants, herbivore, omnivore and/or carnivore. Food chains that are related in an ecosystem form a **food web**. Carnivores are an important part of biodiversity because they regulate herbivore populations so that they do not eat their favorite plant species to extinction.

Importance of plants cannot be ignored as they provide us food but animals also perform various significant jobs in our ecosystem for example; Amphibians play a pivotal role in ecosystem as secondary consumers in many food chains. Tadpoles have significant impact in nutritional cycling. They are herbivorous to omnivorous and are the prey items for both invertebrates and vertebrates. Adult amphibians are the best biological pest controllers. Invertebrates and vertebrates also predate them. Because of their importance in ecosystem, decline or extinction of their population has significant impact on other organisms along with them. Amphibians are particularly sensitive towards the changes in their immediate environment. Amphibians have been described as a marker species, as they provide an important signal to the health of biodiversity, when they are stressed and struggling. Their body along with the water can also soak up various chemical contaminants just like the way a sponge does and therefore amphibians are also called ecological sponges. The amphibians therefore can serve as bioindicators, providing valuable information about the aquatic ecosystem's health.

The tiny bee making that journey to a beautifully coloured flower and way back to the hive is not just collecting the nectar to make honey which we as human being cherish as part of our diet but also doing a valuable job to the plant species involved. The bee unknowingly carries the pollen sticking on the legs and the body and act as a pollinator.

## Loss of biodiversity

We are losing this treasure called biodiversity because of many reasons, mostly due to the human-activities (anthropogenic activities). Sometimes it is because of the fascination for the items derived from the animal body/body parts or as a result of urbanization process. The human population is constantly growing but the space on mother earth is limited. Habitat loss due to deforestation as more of the trees are being cut under growing human population pressure is a major threat for biodiversity.

The Tibetan antelope, or chiru, produces a type of wool called *shahtoosh*. It is so fine that a shawl made from it can be pulled through an index-finger ring. Such a shawl may cost up to \$16,000, making it among the most expensive in the world. But what does this mean for the antelope that wears the wool?



**Source:** [http://www.zzzlife.com/wp-content/uploads/2011/08/Tibetan\\_antelope3.jpg](http://www.zzzlife.com/wp-content/uploads/2011/08/Tibetan_antelope3.jpg)

One shahtoosh shawl meant at least the lives of five chirus. About 20,000 chirus from the Tibetan plateau are said to be poached each year. This occurs even though the animal is supposed to be protected under various endangered species acts. Moreover, in 1979 a ban was placed on trade in *shahtoosh* wool. Yet, since then, the number of chirus has continued to diminish.



The golden toad of Costa Rica was among the first casualties of amphibian declines. (Last seen in 1989).

**Source:** [http://www.supergreenme.com/data/images/35/500x333\\_Golden-toad--Bufo\\_periglenes.jpg](http://www.supergreenme.com/data/images/35/500x333_Golden-toad--Bufo_periglenes.jpg)



*Rana pipiens*

**Source:** <http://www.denniskalma.com/rana%20pipiens.jpg>

Killing the animal directly is not the only way via which we are losing biodiversity. Atrazine, a widely used pesticide is making leopard frogs (*Rana pipiens*) hermaphrodite (bearing both male and female gonads in the same organism). Atrazine gets into aquatic water body, by means of agriculture runoff. It has the ability to disrupt sex hormones. This may be one of the causal agents for amphibian decline, world over.

The leopard frog is not the only victim, struggling hard to live on, even the large birds of prey, the vultures are experiencing the threat to life and their population has crashed down by 97%.

Vultures are called nature's sweepers as they provide a useful service by scavenging on carcasses, and thus, preventing the spread of any disease (due to rotting of carcass). The careless and casual



Oriental white-backed vulture (*Gyps bengalensis*)

Source: [http://www.cosmosmagazine.com/files/imagecache/news/files/20080505\\_vulture.jpg](http://www.cosmosmagazine.com/files/imagecache/news/files/20080505_vulture.jpg)

use of an anti-inflammatory drug, diclofenac used by cattle farmers as a popular cure to treat a variety of diseases is supposed to be the reason behind the severely declined population of vultures. The vultures feeding on carcasses of cows treated with the drug died of kidney failure.

Lion, Tiger, Indian one horned Rhinoceros, Elephant and Olive Ridley Turtle are also facing the threat to become extinct if steps are not taken to save them, as all these animals have already become endangered, that is facing a serious threat to become extinct very soon and the population size is small.

## Threats

It has long been feared that human activity is causing massive extinctions. Despite increased efforts at conservation, it has not been enough and biodiversity losses continue. The costs associated with deteriorating or vanishing ecosystems will be high. Some of the threats are summarized below:

**Deforestation:** leading to habitat loss

Not only the forests are depleting year by year, but species that depend on the forests are also disappearing.

**Pollution:** in various forms like fertilizer, solid garbage, sewage disposal, pesticides and other man-made chemicals.

Oil spills have been a major and really threatening reason in the recent past for biodiversity loss.

**Global warming, Ozone layer depletion, Acid Rain** are some other factors responsible for biodiversity loss.

**Man-Animal Conflict:** A major problem associated with the conservation of wild animals especially the herbivores like elephants in India is that of crop depredation and man-slaughter. Animals such as elephants, gaur, sambar, wild boar and birds like peacock, cause extensive damage to the crops. This phenomenon has registered significant increase in recent years due to habitat fragmentation and degradation of natural forests and corridors.

**Poaching:** The abundance of wild animals and high demand for their products in the market pose threat to wild animals. Herbivores like gaur, sambar, chital etc are being poached for their meat. A lot of other not so spectacular species of animals ranging from reptiles to birds as well as plants and medicinal herbs are all part of the illegal wildlife trade.

**Invasive species:** An area/locality teeming with life forms comprises various organisms which stay comfortably with each other. The populations in a locality consists of plants, herbivores feeding on green plants and thus constantly keeping the green cover trimmed and carnivores eating and thus surviving on herbivores and keeping their population under constant check. Removal of a predator from the locality/ an ecosystem almost always imparts negative effects on the ecological balance. Similarly an **alien** or **invasive species** which has no known competitor or natural predator in the locality/area of invasion often displace and sometimes even force the native species (the old/earlier habitant species) to extinction. Examples of plant invasion in Kerala include Water hyacinth (*Eichornia crassipes*) and Lantana (*Lantana camara*). The weed water hyacinth, prevents sunlight and oxygen from reaching the water column and submerged plants. By crowding out native aquatic plants, it dramatically reduces biological diversity in aquatic ecosystems. Listed as one the 100 most dangerous invasive alien species of the world, this aquatic weed native to South America, was introduced to the country as an ornamental plant for cultivation in ponds because of its beautiful, large purple and violet flowers.

Conservation of ecosystems and the species within them would help to maintain the natural balances disrupted by recent human activity.

## What you can do?

Save energy

Recycle and reuse

Use both sides of the paper , recycle your news papers and magazines

Be a smart shopper

Buy recycled paper products, like envelopes, chart papers

Use efficient transport

Less air pollution

Do not buy things made from animals avoid ivory products ,fur coats, toosh shawls, leather belts ,leather bags, leather wallets made up from endangered animals skin.

### **Suggestive activities:**

In order to develop the biodiversity consciousness among students, the action oriented biodiversity education methods such as active classroom sessions (quiz, discussions, painting competitions, debates etc.), hands-on activities, experiential education, and field exposures that are vital to achieve sustainable biodiversity knowledge and motivate to protect and conserve local biodiversity should be employed.

Few suggestions are:

1. Organizing nature trails in wildlife sanctuaries, parks /forest to know biodiversity.
2. Collecting various types of bird features and making a scarp –book out of those, pasting the picture of the bird along with the feature.
3. Making a botanical garden in the school, putting signposts and providing some information about the tree/herb/shrub.
4. Making a herbarium
5. Making bird houses and placing at school grounds (students can be asked to make small bird houses out of old and discarded shoe boxes at home as well).
6. Planting saplings increasing the green cover of the school, student care-taker (adopt a tree)
7. Maintaining a small nursery at school, and providing free saplings to students to plant in the neighbourhood.



8. Depending upon the number of students ,name individual student or group of students after endangered species and collecting information about the same.
9. Collecting articles ,news items ,related to environmental issues affecting biodiversity, from magazines or newspapers for a week and pasting in a scrap book.
10. Organizing quizzes, painting competitions, essay competitions.
11. Making small index cards (with a picture and information about a plant/animal).
12. Puzzles (cross words, hidden names) match the tail with the animal, match the print (stripes, spots) with the animal), playing recorded sounds of various animals and students could be asked to recognize the animal.
13. Making paper bags out of waste /used paper.
14. Sorting out bio-degradable from non-biodegradable waste and use of separate bins .

## Other Activities

### Activity 1: The Value of Being Different

1. Go to your school ground , or a nearby park.
2. Look around at the trees. Are they different or are they the same?
3. Have students pair off or form small groups and find their own tree. Once they have found their tree, ask them to do the following:
  - a. Use your four senses to get to know your tree.  
How does it look? Feel? Smell?
  - b. Find things that make your tree unique or different.
  - c. Match up with another group and explain to them why your tree is the same or different from theirs, and discuss these differences.

### Activity 2: Mini-Forest in your school grounds

1. Divide the students into small groups and go to an area of your school ground, or park, where a variety of plants and insects may be found.
2. Have each group choose a small study area, and mark off the area (e.g. string, etc). Mark off an area of about 50cm.
3. Inspect the marked off area for different types of plants and insects. Use magnifying glasses to get a closer look.
4. What do you see? Are there any plants? Is anything moving?  
What is dead? What is alive?
5. Have each group visit each other's areas and compare observations.
6. Sit in a circle and discuss the similarities and differences. Why is it important to have lots of different things in an ecosystem?

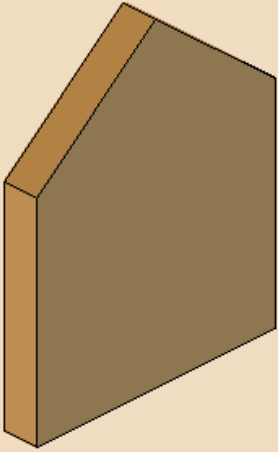
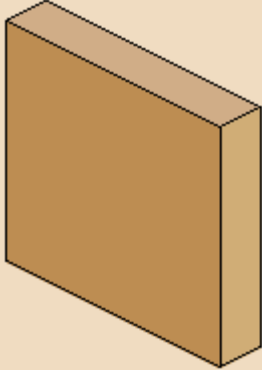

### Activity 3: Making a Bird House



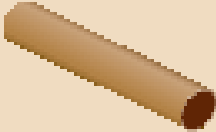


**STEP 1.**

Cut out the pieces. Use 3/4" thick wooden plank for the whole thing, and a 3/8" diameter dowel for the perch.

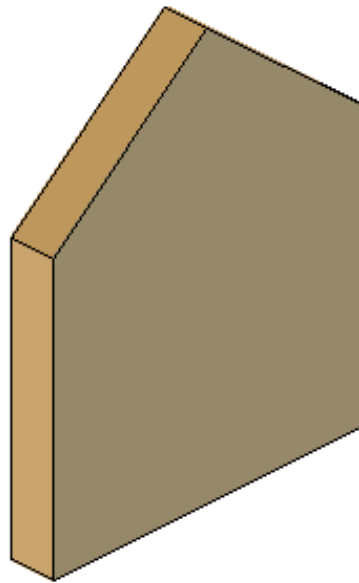
Here are the sizes of 3/4" thick wood to cut for the Bird's Bird House.

Quantity	Length	Width	Part	
(2)	8½"	5½"	Front & Back	
(2)	4½"	4"	Sides	
(1)	5½"	3¾"	Floor	

(1)	5¼"	6½"	Left Roof	
(1)	6"	6½"	Right Roof	
Here is the size of dowel to cut for the Bird's Bird House.				
Quantity	Length	Diameter	Part	
(1)	2"	3/8"	Perch	

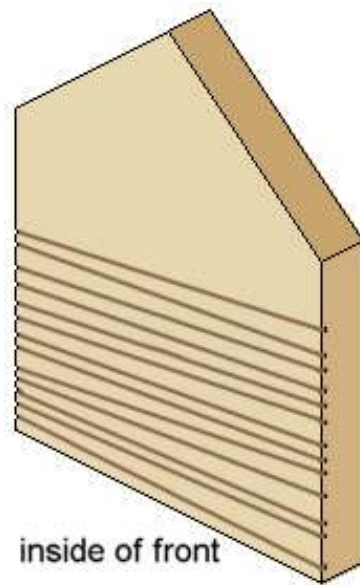
### STEP 2.

Cut the 45° angles on the back and front.



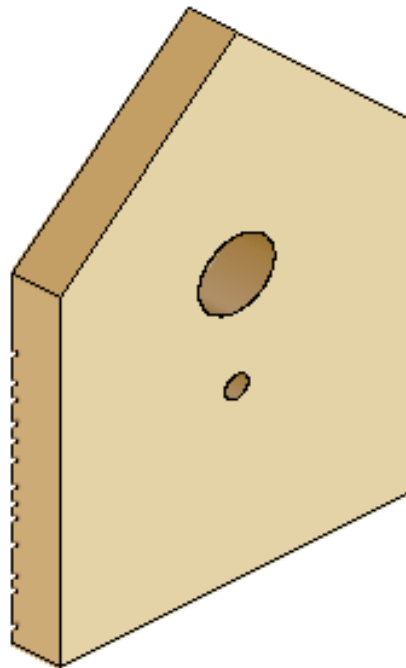
### STEP 3.

Sometimes newly hatched baby birds have a tough time getting a grip on the smooth wood of the inside of ordinary bird houses, and the poor wee things can't get out. So, make little ridges with a saw across the inner surface of the front wall. Then the hatchlings will easily climb up to the door when they are ready.



**STEP 4.**

Drill the 1¼" door hole. The center of the door is 4¾" from the bottom. Drill a 3/8" hole ½" deep for the perch, on the outside of the front. The center of the perch is 3" from the bottom.



**STEP 5.**

Get a big wood screw about 3 or 4 inches long for mounting the Bird House to a fence post. Drill a 1/8" hole through the back piece of the Bird House 4¾" up from the bottom edge. Get the screw started before assembling the Bird House. The mounting screw will line up with the door hole, so you will be able to tighten it up after assembly and painting.

**STEP 6.**

When nailing the Bird House together, there should be a 1/8” drainage gap at the front and back of the floor.

Use wood glue to set the perch in place.

STEP 7.

Paint the outside of the birdhouse but not the inside. Birds prefer natural wood for their interior decor.

STEP 8.

Find a good spot for Bird House outside, and tighten in the mounting screw. Put another one in at an angle from the bottom for stability, using a pilot hole there as well.

**Materials required:** notebook, pencils, magnifying glasses, strings, measuring tapes, screws, nails, hammer, saw, glue, and some wood.

**Evaluation:** On the basis of activities performed inside and outside the class-room, students can be assessed and evaluated for the understanding of the concept and value of biodiversity conservation.

**Various parameters for evaluation :** Tools like multiple choice questions, fill in the blanks, match the patterns, short answer type questions for example;

1. Define biodiversity
2. Identify threats to biodiversity
3. Provide examples of the importance of biodiversity.

**Values developed**

1. Understanding the relevance of biodiversity to real world issues.
2. Understanding the relationship between biodiversity, climate change, and human health and well-being.
3. Development of respect towards all life-forms (big/small).
4. Changes in lifestyle choices (avoiding products derived from endangered animal’s skin).
5. Sensible utilization of resources (especially non-renewable ones).
6. Understanding the Judicial and careful use of chemicals like pesticides, fertilizers and drugs

## **ENVIRONMENT EDUCATION FOR SUSTAINABLE DEVELOPMENT**

During the recent decades the blind race for industrial growth has enhanced human activities. This has induced stresses on environment, necessitating the understanding of environment. It is more critical than ever before for the humankind as a whole to have a clear understanding of environmental concerns and to follow sustainable development practices. The degradation of our environment is linked to continuing problems of global warming, pollution, loss of forest, solid waste disposal, and issues related to economic productivity and national as well as ecological security. Environmental education focusing on real-world contexts and issues often begins close to home, encouraging learners to understand and forge connections with their immediate surroundings. The awareness, knowledge, and skills needed for these local connections and understandings provide a base for moving out into larger systems, broader issues, and a more sophisticated comprehension of causes, connections, and consequences.

### **Environmental education**

Environmental education refers to organized efforts to teach about how natural environments function and, particularly, how human beings can manage their behavior and ecosystems in order to live sustainably. The term is often used to imply education within the school system, from primary to post-secondary. Environmental education is a learning process that increases people’s knowledge and awareness about the environment and associated challenges, develops the necessary skills and expertise to address the

challenges, and fosters attitudes, motivations, and commitments to make informed decisions and take responsible action (UNESCO, Tbilisi Declaration, 1978).

## **Sustainable Development**

The common definition for sustainable development is: “ Development that meets the needs of the present without compromising the ability of future generation to meet their own needs” Sustainable development is economic development that exclusively relies upon and is firmly rooted in the integrity and sustainability of the natural environment. National resources management has emerged in line with the evolving concept of sustainable development over the past three decades. If nature’s resource base is irredeemably depleted or irreversibly degraded , the means of wealth creation for social welfare will be seriously jeopardized. Without environmental sustainability, it is impossible to achieve sustainable development.

## **Importance of Environmental education**

The ultimate goal of environmental education is to develop an environmentally literate public. It needs to address the connection between our conception and practice of education and our relationship as human cultures to life-sustaining ecological systems. For each environmental issue there are many perspectives and much uncertainty. Environmental education cultivates the ability to recognize uncertainty, envision alternative scenarios, and adapt to changing conditions and information. This knowledge, skill, and mindset translate into a citizenry who is better equipped to address its common problems and take advantage of opportunities, whether environmental concerns are involved or not.

In order to achieve the goals of sustainable development, people need to become aware of the environmental issues and acquire background knowledge to enable them to make and influence decisions. Environmental education is thus concerned with attitude towards, and decisions about environment quality, with informed management of resources, and with the ethical considerations that relates to these. Recognizing the importance of environmental education at all levels, the Hon’ble Supreme Court of India ruled that a course on Environment be made mandatory at the undergraduate level to sensitize the youth to environmental issues and concerns. As per the Supreme Court direction, the University Grants Commission introduced six months of compulsory environmental course in all the universities and colleges during the academic year 2004-05.

The declaration of the decade for Education for Sustainable Development (ESD) beginning in 2005, by the United Nations has provided further impetus. The goal is to create a *sustainable world* through active participation of citizens. Thus, ESD is seen as a process that develops vision, builds capacity, and empowers to make changes in human societies. Education has a pivotal role to play in achieving a sustainable economy and society.

## **Benefits of Environment Education Programmes**

The management of ecosystem involves inventorying and monitoring, and applying integrated technologies, methodologies, and interdisciplinary approaches for its conservation. Hence, now it is even more critical than ever before for the human beings to be environmentally literate. To realise this vision, both ecological and environmental education must become a fundamental part of the education system at all levels of education. Environmental education programme at schools would generate ecological and environmental quality data at regional levels, which helps the local administration in the management of natural resources. Involvement of schools (every year) helps in getting the data updated. The benefits are:

- At the students level – students and local public get sensitised about their local/neighbourhood environment, socio-economic backgrounds and ecological relevance.
- When carried out periodically, over a period of time a good repository of local environmental information is generated by the high school students for their neighbourhood, which is a *contribution* in itself.

Fate of the earth's remaining natural resources depends on the sustainable management and development actions by humans. India will certainly achieve the goals of sustainable development only if it succeeds in developing environmentally literate public with the knowledge of ecosystems and the environment. This requires sincere effort and involvement of all sections of the society - decision makers, educators, and general public at large. It is the right time for all of us to plan our natural resources through conservation approaches. Sustainable ecosystem management and development leading to conservation of natural resources is the key to our secured future.

## Role of Eco-Club

Eco- Clubs can play a pivotal role in spreading awareness of Environmental Education for Sustainable Development among the students . A variety of activities and programmes can be employed to spread awareness among students, a few of them are:

- **Environmental Review and an Action Plan** to set achievable targets and deadlines for raising awareness, acquiring new perspectives, values, knowledge and skills; and formal and informal processes leading to changed behaviour in support of a sustainable environment.
- **Essay competition and quiz programmes.**
- **Drama, Nukkad Natak, Poetry Recital, Singing Programmes.**
- **Poster Making, Slogan Writing Competitions.**
- **Tree Plantation, Van Mahotsav Celebrations.**
- **Workshop/ training programmes** to train students and teachers in environmental monitoring (this would include hands-on training). Paper presentation by students in international and national symposium / seminars.
- **Development of environment education materials in self learning format**

## Evaluation

To ensure that progress is made and that achievements are celebrated, monitoring and evaluation are necessary. Certain themes are studied in the classroom through Curriculum Work, and all students are involved in practical initiatives. Each school should develop its own Eco-code (like not using plastics in schools, using different dustbins for biodegradable and non biodegradable waste etc.), outlining the environmental values and objectives and what the students are striving toward. After a period of participation, an evaluation of the success of these initiatives and the methodology is undertaken, and each school should be assessed. Successful Eco-clubs (and schools) and students are awarded with the **Eco Award** during the Annual Functions.

## Word find

*There are twenty Biodiversity related terms hiding in this puzzle. See if you can find them. The names can be read upwards, downwards, backwards or diagonally.*

S	Q	E	S	P	A	R	R	O	W	H	B	N	L
N	T	A	L	A	I	R	A	H	G	B	G	M	E
A	B	Z	T	I	G	E	R	Y	C	O	O	S	O
I	A	C	F	V	Y	R	H	M	U	E	R	I	P
L	C	O	R	A	L	S	I	R	T	U	F	P	A
Z	T	E	A	A	W	R	N	N	B	U	R	Y	R
L	E	W	U	I	B	A	O	S	N	C	T	U	D
I	R	B	K	S	A	T	W	G	I	Q	C	A	O
C	I	X	M	L	I	K	I	O	H	T	O	M	C
H	A	Z	W	U	N	R	U	L	A	D	T	S	T
E	V	A	Q	W	A	L	G	A	E	F	T	I	O
N	T	S	U	O	V	T	M	A	N	G	O	R	P
X	O	N	T	U	R	T	L	E	V	P	N	U	U
M	P	G	H	J	K	H	S	I	F	R	A	T	S