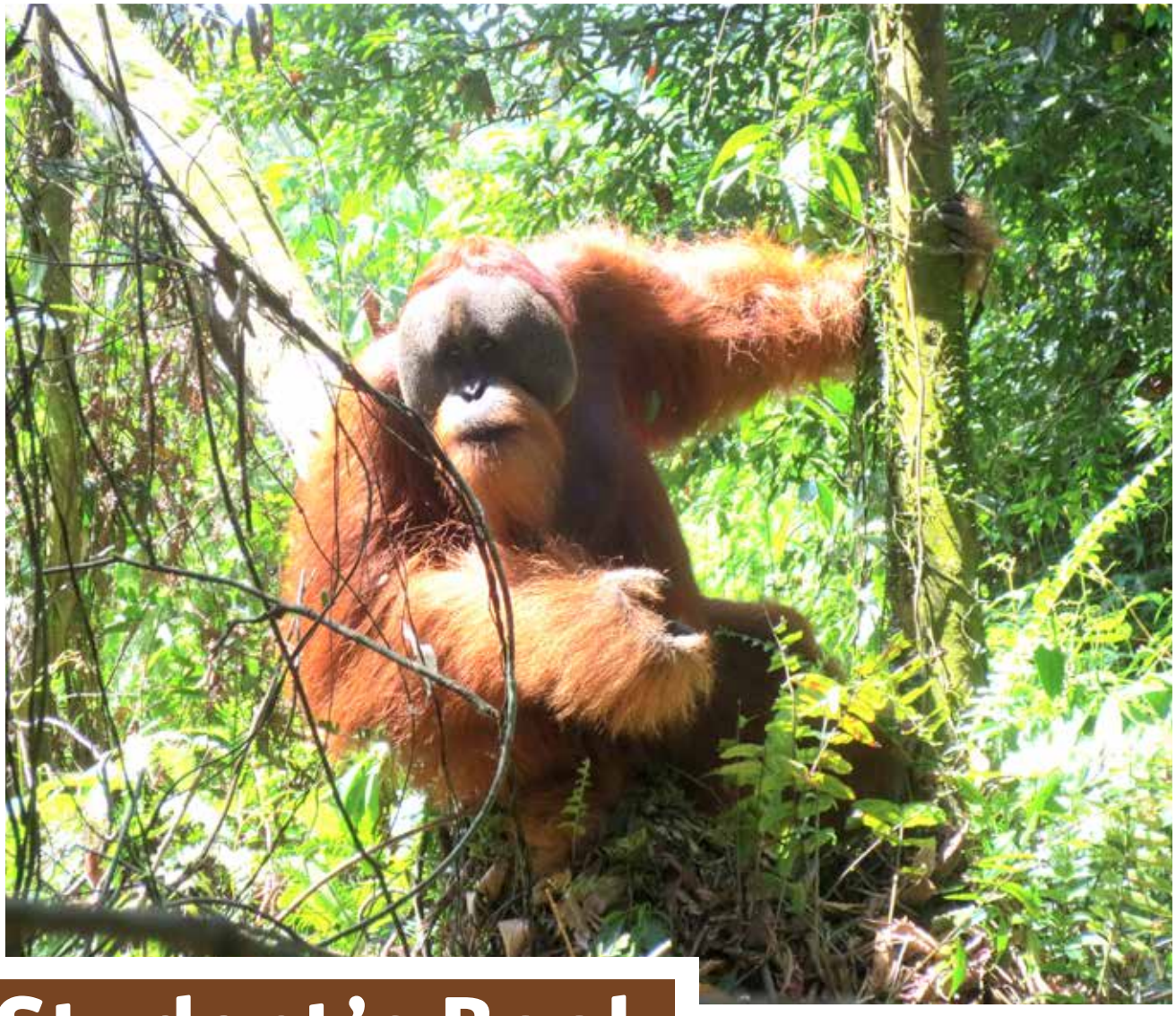
ENVIRONMENTAL SCIENCE BASICS

An introductory course for Myanmar adults



Student's Book

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The Curriculum Project

Educasia
Education in Context

ABOUT

US AND THIS BOOK

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Contents

Introduction

Environmental Science Basics is a course designed for Myanmar adults. It provides a comprehensive introduction of essential environmental concepts and an overview of Myanmar's natural environment. It offers a wide variety of practical activities to equip learners with skills to research and analyze their natural surroundings. It also encourages the learners to actively protect and conserve the habitats and ecosystems we live in.

This book makes up Part I of the ***"Sustainable Development and Environmental Conservation curriculum"*** series. The curriculum aims to prepare learners to conduct projects and activities for healthy ecosystems and locally sustainable development.

Environmental Science Basics is designed primarily for a taught course but can be used as a self-study resource. It is written at a low intermediate level of English and takes between 22 to 30 hours (excluding additional activities) to complete.

Who is it for?

The book is useful for anyone interested in the subject. Specifically it's for people who:
- Want the skills to analyze their natural environment
- Want to expand or refresh their knowledge of the subject
- Are involved in environmental protection activities
- Are involved in environmental education

It is a useful resource for:
- Various classroom settings including community schools, religious schools, etc.
- Environmental education programs and environmental NGOs and CBOs.

Components

1. **Student's Book**
   The student's Book has 10 lessons. Each lesson should take between 90 to 120 minutes to complete under an instructor's guidance. It contains readings, activities, exercises and practice, discussion and reflection questions. Each lesson suggests an additional activity- mostly beneficial when conducted outside the classroom.
   Supplementary material at the back of book includes:
   - a **Projects Package** from which students pick an extended project to conduct individually or in groups usually.
   - a **Glossary** with definitions and translations.
   - **Translations**

Learning Objectives

	Lessons	Objectives
1.	What is Environment?	1) Describe what an environment is and provide examples 2) Identify the different environments and provide examples 3) Explain the intereactions between the different environments
2.	Ecosystems, Habitats & Biomes	1) Explain what ecosystems are 2) List and describe the major biomes 3) Explain how ecosystems change and are affected
3.	Classification and Biodiversity	1) Use the classification system to classify species 2) Explain what biodiversity is and its importance 3) Identify and analyze biodiversity threats
4.	Matter, Atoms and Molecules	1) Explain what matter is in its various forms 2) Recognize chemical and physical changes 3) Debate the differences between organic and inorganic food
5.	Food Chains & Food Webs	1) Describe food chains and food webs 2) Identify and describe the role of producers, cosumers, and decomposers 3) Describe how energy and nutrients move along the food chain
6.	Earth's Cycles	1) Explain water, carbon, nitrogen and oxygen cycles 2) Recognize the stages of earth cycles
7.	Natural Resources	1) Categorize natural resources 2) Explain natural resources management 3) Explain the difference between renewable and non-renewable resources
8.	Energy	1) Explain and the identify the different types of energy 2) Explain the difference between renewable and non-renewable energy
9.	What is a Healthy Ecosytem?	1) Explain the importance of healthy ecosystems 2) Determine how healthy an ecosystem is using by key indicators 3) Indicate how to promote a healthy ecosystem
10.	Overview of Myanmar's Natural Environment	1) Describe Myanmar's biodiversity, climate and its various ecosystems 2) Determine the interactions between Myanmar people and their various ecosystems 3) Explain major human environments in Myanmar 4) Analyze major issues in Myanmar's environments and propose solutions

Use this page for your notes.

Lesson 1

What is Environment?

What is around us?

Activity: observation

A **Look around you, both inside and outside the room you are in. What do you see? Close your eyes and take a deep breath. Listen. What do you hear? What do you smell?**

B **Complete the table below and share your answers. Try to write at least 10 things in each column.** **Work in pairs.**

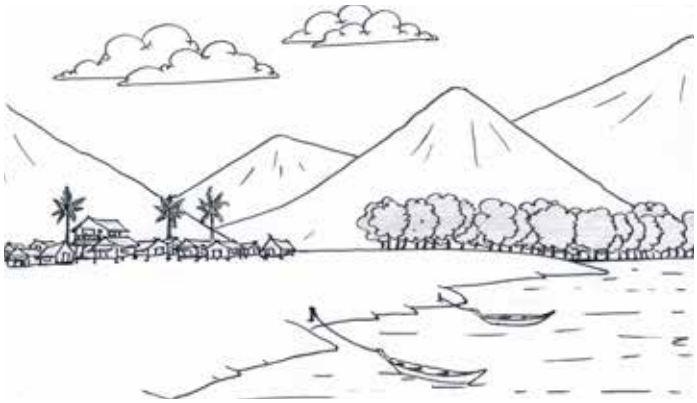
Inside, I can see...	Outside, I can see...	I can hear...	I can smell...

Everything you listed is part of your environment. Your environment includes everything that surrounds you, from the ground you walk on to the air you breathe.

What is environment?

Reading

Environment is a very broad term and there are many different kinds of environments. An environment can be as small as a few inches of water in a bucket (a great environment for a mosquito to lay her eggs in) or as large as the Himalayan Mountain range; as small as a single classroom or as large as a city such as Yangon. Your digestive system, home to millions of bacteria, is an environment, as is the ocean.



There are different ways to categorize environments:

1. **Human environments or built environments** are the areas where humans live, work, worship and study. The human environment includes everything made by people. Farms, villages, and factories are human environments as are hospitals, pagodas, mosques and mines. All products made by humans such as plastic bags, computers, charcoal, and diesel are all part of the human environment.
2. **Socio-cultural environments** are a society's beliefs, customs, traditions, and practices. Education, religion, politics, and language all affect the socio-cultural environment. People both affect and are affected by the socio-cultural environment in which they live.
3. The **natural environment** is what this book will focus on. The natural environment includes all naturally occurring living and nonliving things in an area - everything on earth that is not created by humans. The land, the sea, the air, and all living organisms are part of the natural environment. The natural environment is affected by several different factors:

    - **Climate and weather**: A place with lots of rain will have a different environment from a place with very little rain.
    - **Elevation**: Places that have a high elevation are usually colder than places at sea level.
    - **Latitude**: Places near the equator are usually warmer than places north or south of the equator.

Vocabulary

Climate: the weather conditions prevailing in an area in general or over a long period

Elevation: height above a given level, especially sea level

Latitude: distance of a place north or south of the earth's equator

★ *Exercise*

C **Write each of the items below in the appropriate column. After you complete the exercise with your partner, share your results with the rest of the class. <u>Work in pairs.</u>**

- Plastic bags
- Coal
- A community forest
- Rubber plantation
- A rice paddy
- Wind
- Shaking hands
- A school
- The call to prayer
- River bank
- A pagoda
- Marriage
- Bay of Bengal
- Voting
- Coral reef
- A dam
- Electricity
- Smoke
- An elephant
- Taking your shoes off
- Man-made fish pond

Human/Built Environment	Socio-Cultural Environment	Natural Enviroment

Interacting environments

Each of these three environments affect and are affected by each other. Here are some examples:

- Expanding a human environment such as building a new housing development will destroy parts of the natural environment.
- The natural environment influences the types of homes people build and the types of materials homes are made out of.
- The natural environment affects human culture. Human diet and clothing is affected by the climate.

Discussion

D **Discuss and answer the following questions. <u>Work in groups.</u>**

1) How does the natural environment affect how people build homes? Give examples.
2) How has the natural environment in your area been affected by the human environment?
3) What are some examples of how the socio-cultural environment affects the daily life of people in your community?

You and your enviroment

Discussion

E **What sort of environment do you live in? The questions below will help you better understand the environment in your area. First, answer the questions or the issues silently on your own. Then, share your results with your partner. The final step is to share your answers with the rest of the class.**

1. What is the approximate temperature outside? Is this temperature normal for this time of year?
2. When did it last rain? Does it rain a lot in your area? Do you know how much rain your area gets on an average year? Is there a rainy season, or does it rain throughout the year?
3. If you walk from your school for 10 minutes how many different kinds of trees will you see?
4. List the different birds that are common in your area (birds that you see every day). Now, list birds that you see, but only rarely.
5. What kinds of wild animals live in your area? How often do you see a wild animal?
6. Is there a body of water nearby, such as a river, lake or the sea? Is there a forest you can walk to?
7. Are there many crops grown in your area? If so, what kind? Do you grow any of your own food?
8. What sort of fuel do most people use to cook?
9. Where do you get your drinking water from?
10. What happens to the waste in your community? Is there a pick-up service, or do you burn it? Bury it?
11. Where does most of the food you eat come from? Is it grown in the local area? Does it come from somewhere else in Myanmar or from a different country?

Humans and our natural environment

Reading

Humans depend on our natural environment for survival. Different people have very different opinions on how much humans depend on our natural environment for survival. Here are some opinions expressed by two different people.

F **Read the written speeches from an environmental studies teacher and an environmental activist and answer the questions that follow. <u>Work in pairs.</u>**

Like all livings, humans depend on the natural environment for our survival. Unlike all other animals though, humans have great power to affect our natural environment. Humans are causing tremendous damage, but we also have the power to make changes that can help to protect, **conserve** and **preserve** our natural environment, rather than harm it. You can have a huge impact on your environment. You can help to improve the natural environment or hurt it. Which do you prefer? The choice is yours.

Our natural environment is in trouble. There are many problems that are harming our natural environment. Most of these problems are caused by humans. For example, cutting down natural forests to plant palm oil plantations or building homes destroys the **habitat** for many animals. Building dams stops **fertile** soil from flowing downstream. Driving cars produces **carbon dioxide**, which contributes to global warming. Plastic bags kill animals (such as turtles), cause pollution and block drains.

Vocabulary

Conserve: protect (something, especially an environmentally or culturally important place or thing) from harm

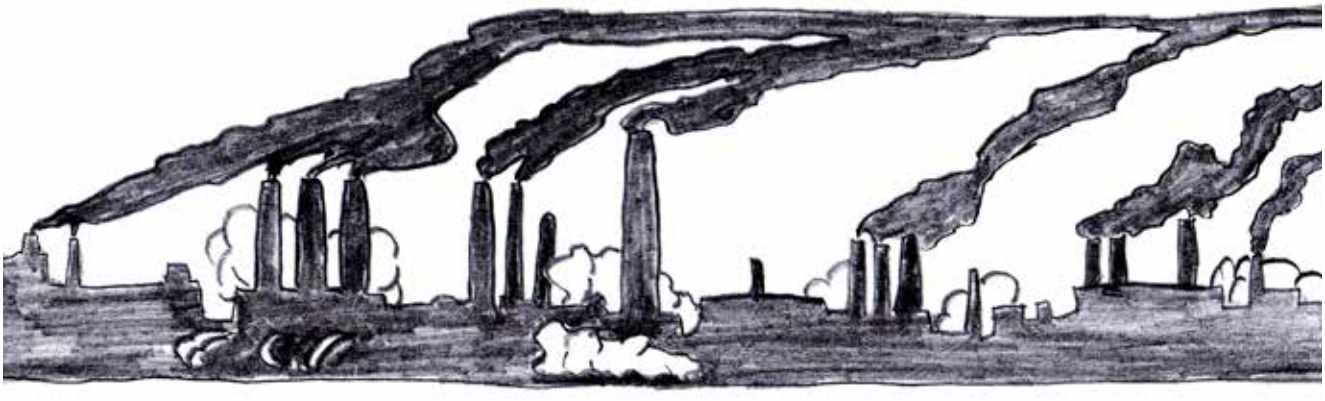
Preserve: maintain (something) in its original or existing state

Habitat: the natural home or environment of an animal, plant, or other organism

Fertile: producing or capable of producing abundant vegetation or crops

Carbon dioxide: a colorless, odorless gas produced by burning carbon and organic compounds and by respiration

1) How are humans impacting the environment?
2) What other environmental problems can you think of?
3) What major environmental problems are in your community? in Myanmar?



Reflection

G **Answer the following questions.** **<u>Discuss as a class.</u>**

1) Should we try to protect our natural environment? If yes, why?
2) How can we protect our natural enviroment?

Additional Activity

List all the positive and negative aspects of your human/ built, socio-cultural and natural environment. You can collect information by brainstorming, observing your neighbourhood/ city? village and interviewing your community members.

Lesson 2

Ecosystems, Habitats & Biomes

Ecosytems

Brainstorm

A **Read the definition of "ecosystem" in the box and its translation in the glossary and brainstorm all the words you associate with it.** **Work in pairs.**

Vocabulary

A **habitat** is the natural home or environment of a plant or animal. It is similar to an ecosystem, except that **ecosystems** emphasize community and the interaction of plants and animals living in that community.

Reading

What is an ecosystem?

An ecosystem is a community of living organisms and nonliving factors interacting as a system in a particular area. All parts of the community, both the living and the nonliving, affect one another. Examples of different ecosystems include a mangrove forest growing along the Irrawaddy river in the delta, a rice paddy, and a coral reef. Even the inside of your body is an ecosystem, alive with many different kinds of bacteria.
All the living organisms within an ecosystem have a role to play in the health of an ecosystem.
Just, as a bird needs two strong wings to fly, the health of an ecosystem depends on all parts working together.
Ecosystems are also affected by non-living things as well as natural forces and conditions. For example, due to climate change, the oceans are changing – they are getting warmer and more acidic. This is harming the coral reef ecosystem. Changing any part of the community – whether that part is living or nonliving - can have a huge impact on the entire ecosystem's health and nature.

Exercise

B **Look at the picture of the river ecosystem and list the different organisms.**
Work in pairs.

Discussion

C **Discuss and answer the following questions.** **Work in groups.**

1) Eagles do not actually live in the river. Why are they part of the river ecosystem?
2) Imagine that a large factory is built on the edge of the river. List five ways this might harm the river ecosystem.
3) List at least 3 nonliving factors that affect a river ecosystem.

Case study

D **Read the case studies individually. Then, work in pairs answer the questions. Share your ideas with the class. Think/Pair/Share.**

Burmese Pythons cause damage in Florida!

A new visitor, the Giant Burmese Python, is killing off the native mammals of the Florida Everglades national park. In areas where the python is well established, rabbits and foxes have completely disappeared. Sightings of animals such as raccoons, opossums, and deer are down by more than 90 % since the Burmese Pythons were first seen in the Florida Everglades in the 1980s.

How did the Giant Burmese Python travel thousands of miles from the tropical forests of Myanmar to Florida?

With the help of humans! Perhaps afraid of the snake as it grew so large, people released their pet pythons into the wild. Other snakes escaped. The snakes loved their new ecosystem. They adapted very well to the hot, wet climate of the Florida Everglades because it was similar to their native environment. There were many animals to eat including birds, rabbits, foxes, raccoons, and baby deer. The pythons discovered that these animals were easy to catch because they never learned to be afraid of large snakes since there were none in the area. So, the pythons had a very easy life, grew and reproduced. Now they are very well established in the Florida Everglades.

The creatures of all ecosystems are interconnected. As the population of prey animals such as rabbits, opossums and deer declined, the population of predators, which rely on those animals, such as bobcats, panthers and coyotes, declined as well.

Vocabulary

A **native species** is an organism that has been living in an area for many years. They live in the area naturally and were not brought there by humans.

An **invasive species** is a plant, insect, or animal that was 1) brought to an area, usually by humans, and 2) causes serious environmental change.

1) Why are native birds, rabbits, foxes and raccoons so easy for the Burmese pythons to catch?
2) Burmese pythons rarely eat bobcats, panthers, and coyotes. Why did the population of these animals decrease due to the invasion of the Burmese python?
3) What kind of climate do Burmese pythons like?

E **Read the case study and mind map all the changes that happened when the wolves disappeared from Yellowstone. Work individually.**

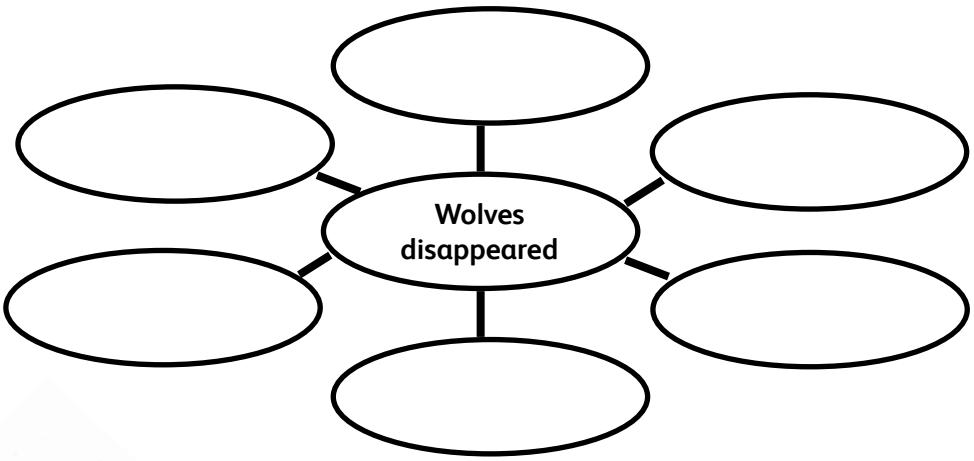
Re-introduction of Wolves Causes an Avalanche of Change

Many years ago, wolves lived in the area that is now Yellowstone National Park in northern USA. But hunters and farmers killed them all. Wolves love to eat elk, a large deer like animal. When there were no more wolves left, the elk population grew and the elk didn't have to move around so much since there were no more wolves to run away from. In the wintertime they stayed near rivers and streams where they could eat willow trees. Since they had plenty of food, the elk population grew. As the years went by, more and more willow trees disappeared.

Beavers also eat willow trees. As the willow trees disappeared, the population of beavers declined because they did not have enough to eat. Beavers build dams across streams out of sticks. These dams provide still, deep water, which is a good ecosystem for young fish. As the population of beavers declined, the number of beaver dams did as well. This caused the population of fish to decline.

Then in 1995, the wolves were re-introduced to Yellowstone Park. The wolves hunted the elk, so the elk had to move all the time. They could no longer stay all winter near the streambeds eating all the willow trees. So the willow trees grew back. What do you think happened then?

There was more food for the beavers, so the beaver population increased. They built more dams so there were more ecosystems suitable for young fish, so the population of fish increased as well. The population of songbirds also increased, because they like to live in the willow trees during the summer. In addition, there was less erosion along the stream banks because the willow trees helped to prevent it.



All members of an ecosystem community are interconnected. When one community member changes, the other community members change in response. Each cause (change) has an effect.

Activity: cause and effect

F **Based on the case studies, complete the effect chains individually and then share with the class.**

Burmese Pythons were relaeased into the Flordia Everglades.	Effect A _____ Because _____	Effect B _____ Because _____	Effect C _____ Because _____

Wolves are reintroduced	Effect A _____ _____	Effect B _____ _____	Effect C _____ _____	Effect D _____ _____

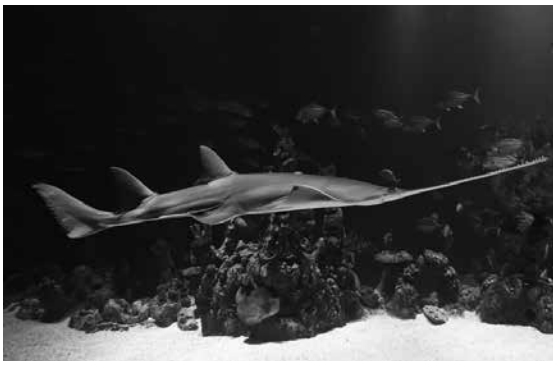
What are biomes?

The natural environment can be categorized into biomes. Biomes are regions in the world with similar climate (rainfall, temperature, and elevation). This means that the plants and animals that live in a particular biome are also similar. Both plants and animals are well adapted for the particular biome they live in. On our planet, there are 6 major biome types. Each biome contains many different ecosystems.

Reading

G **Read about one biome and teach the class about it. <u>Work in groups.</u>**

Marine/aquatic:
The marine biome is the largest biome on earth, covering about 70 % of the earth's surface. It includes 5 oceans (the Pacific, Atlantic, Indian, Arctic, and Southern) as well as many gulfs and bays. Coral reefs are one of the most important parts of the marine biome as they provide food and shelter to many types of marine creatures. This biome is changing due to **global warming** which is raising ocean temperatures and making the ocean more acidic. Humans are also harming the ocean biome through pollution and over fishing.



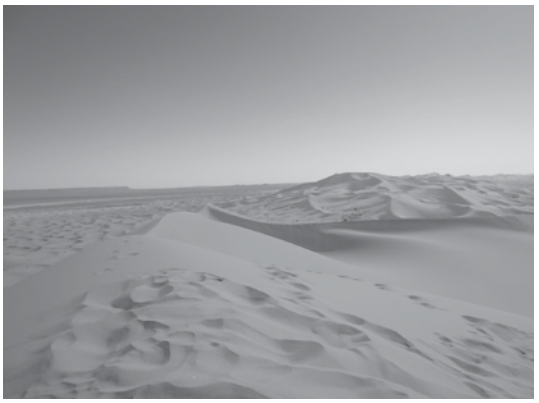
Freshwater
The freshwater biome is essential to all life forms except for those that live in the sea. Most of the fresh water (non salty water) on earth is either frozen (in glaciers or icecaps) or is underground. The freshwater biome includes lakes, rivers, and wetlands. The freshwater biome provides homes to many different kinds of plants and animals, including fish.
This biome also provides water for drinking and irrigation. Many rivers and lakes are becoming polluted and some are shrinking because humans are using so much water. In addition, many rivers are used for damns to provide electricity.

Forest
There are different types of forests on our planet, but all forests have two things in common: they have lots of trees and they breathe. While humans and animals breathe in oxygen and breathe out carbon dioxide, trees breathe in carbon dioxide and breathe out oxygen. Three of the most important types of forests are tropical, temperate or deciduous, and mangrove.**Tropical** are warm and wet and most grow near the equator. There are some tropical rain forests in Myanmar. Amazon is the largest tropical forest in the world. **Temperate or deciduous** forests have four distinct seasons: winter, spring, summer and fall. Most of trees growing in temperate forests are deciduous trees, they lose their leaves every year. **Mangrove forests** are found in warm, muddy areas along the equator. They grow where land, freshwater and the ocean meet. Mangroves provide homes to many marine creatures such as fish, crabs, and shrimp. Because forests, especially tropical forests, provide so much oxygen, **deforestation** is damaging our earth's atmosphere.

Tundra
The tundra is the coldest of all biomes and covers about one fifth of the earth's surface. **Arctic tundra** is located in the Arctic, encircling the north pole. **Alpine tundra** is located around the world on mountaintops where the elevation is too high for trees to grow. Most plants are short and almost no trees grow in the tundra due to the short growing season and permafrost, which is a layer of permanently frozen subsoil. Animals adapt to the long cold winters by breeding and raising their young very quickly during the summer. Many animals hibernate in the winter. There are very few reptiles or amphibians in the tundra biome due to the very cold temperatures.

Grassland
Grasslands, found in every continent except Antarctica, are large, rolling open spaces. In grasslands, the average annual precipitation is great enough to support grasses, and in some areas a few trees. The precipitation is so irregular that drought and fire prevent large forests from growing. Trees grow only near rivers and streams. There are two different types of grasslands; tall-grass, which are humid and very wet, and short-grass, which are dry, with hotter summers and colder winters than the tall-grassland.

Desert
A desert is an area with very little rain. Like the tundra, deserts cover about one fifth of the earth's surface. There are both hot deserts, such as the Sahara Desert in northern Africa and cold deserts, located near the Arctic. Animals in this biome are so well adapted to the lack of water that some never drink water at all. They get all the water they need from the plants they eat. Most animals live in holes underground and are nocturnal (meaning they are awake at night and sleep during the day) to avoid the fierce sun. Plants that live in the desert are also well adapted to the lack of water. Some store water in their stems. Other plants have very large roots systems or few leaves.



Activity: matching

H **In groups of six (each student having studied a different biome), read and match the facts with the appropriate biome. <u>Work in groups.</u>**

Marine	Freshwater	Forest	Tundra	Grassland	Desert

A	The coral reef is one of the most important parts of this biome
B	This biome provides one of the most important natural resources
C	This is the coldest of all biomes
D	This biome has the shortest growing season
E	Wetlands are an important part of this biome
F	Animals hibernate in this biome
G	Most animals that live in this biome live underground and come out at night
H	This biome "breathes"
I	Trees in this biome grow near rivers and streams
J	This covers a very large surface of the earth
K	This biome is being harmed by pollution
L	This biome is found everywhere expect in one continent
M	This biome is found in two types in Myanmar
N	Animal in this biome are active at night

Reflection

Answer the questions below and discuss how these biomes and ecosystems affect your life. <u>Discuss in groups.</u>

1) What biomes are found in Myanmar?
2) What biome is your community in?
3) How does the biome affect the lives of people who live there?

Additional Activity

Research more information **(online or in a library)** about the ecosystems and write in the table the types of plants, animals and soil you might expect to find in those environments.

Ecosystem (Biome)	Plants	Animals	Soil

Lesson 3

Classification and Biodiversity

Classification

Activity: observation

A **Look around, both inside and outside the room you are in, and classify the things you see, hear and smell. Work in pairs.**

Living organisms			Non-living things	
People	Animals	Plants	Natural	Built

Reading

CLASSIFICATION

Classification or Taxonomy is a system scientists have developed to categorize all living things, from mushrooms to humans. There are 7 different levels. The top level is called Kingdom and the bottom level is called Species. (See FAST FACTS: How Humans are classified.)

SPECIES

A **species** is a group of living organisms (including plants, animals, birds, insects and bacteria) that can produce fertile young together. No one knows exactly how many species there are on our planet. New species are still being discovered. Sadly, many more species are disappearing, often through human interference. When a species has entirely disappeared, it is called extinct. A species is called **endangered** or **threatened** when very few members of that species are left. An endangered species may soon become extinct unless steps are made to protect it. Some countries make laws to protect endangered species. These laws include forbidding hunting of threatened species and protecting their natural habitat.

FAST FACTS

How Humans are classified

Kingdom: Animalia
Phylum: Chordata
Class: Mammalia
Order: Primate
Family: Hominida
Genus: Homo
Species: Homo sapiens

Vocabulary

Extinct – A species of animal, insect, bird or other living organism that no longer exists

Endangered: a species of plant or animal that may soon become extinct.

Animal Classification

Mammals = give birth to live young and nurse them with milk. They have hair or fur and they are warm-blooded.
Birds = have feather and wings. They are warm-blooded and lay eggs.
Fish = breath underwater. They have scales and fins. They are cold-blood and lay eggs.
Reptiles = have scales and dry skin. They lay eggs and they are cold-blooded.
Amphibians = live on land and water. They have moist skin and webbed feet.
Invertebrates = have no bones and they are cold-blooded.

Exercise

B **List the animals in the corresponding categories. Work in pairs.**

Mammals	Birds	Fish	Reptiles	Amphibians	Invertebrates	
						Owl, dog, iguana, ant, cat, catfish, lizard, hornbill, shark, toad, spider, dolphin, parrot, salmon, frog, butterfly, salamander, boa, constrictor

Activity: guess

C **Using the numbers on the right, guess the answers to the questions. <u>Work individually.</u>**

1) How many different species of living organisms are there in the world? _____
2) How many different species do you think there are in each of the following categories:

Mammals _____ Insects _____
Fungi _____ Fish _____
Flowering plants _____

29,300	**5.1 million**
about 400,000	**8.7 million**
5,416	**950,000**

Biodiversity

Brainstorm

D **Read the definiton of "biodiversity" in the box and its translation in the glossary and brainstorm all the words you associate with it. <u>Work in pairs.</u>**

Vocabulary

The word **biodiversity** is a combination of 2 words: bio + diversity. Bio comes from the Greek word bios, which means life. **Diversity** means varied, multiplicity, many different elements.

Reading

Biodiversity refers to the many different kinds of species of living organisms on Earth including plants, animals, insects, algae and **bacteria**. Biodiversity can also exist within the same species of an organism.
A bio-diverse area has many different kinds of animals, plants, and other organisms, all of which work together to create a healthy ecosystem. Rain forests and coral reefs are the most bio-diverse environments on earth.

WHY IS BIODIVERSITY IMPORTANT?

Biodiversity is very important to the health of our planet and loss of biodiversity is one of the most damaging environmental problems. People are an important factor in changing biodiversity - we are the only living thing that can change or destroy biodiversity on such a large scale. On the other hand, we are also the only species that can take action to protect biodiversity.

An example of biodiversity's importance:
A patch of forest can grow more and bigger trees if the soil is biodiverse, full of many different organisms that improve the quality of the soil, such as earthworms and microbes.

Fast Fact: New species in the Greater Mekong

139 new species including 90 plants, 23 reptiles, 16 amphibians, 9 fish, and 1 mammal were discovered in 2014 in Myanmar and the rest of the Greater Mekong region (Myanmar, Cambodia, Laos, Thailand and Vietnam). Newly discovered species in Myanmar include the Myanmar snub-nosed monkey, a new species of dragon fish, a new frog, and a new type of ginger plant.

FAST FACTS: Bacteria

Bacteria are tiny organisms made of a single cell. They are so small they can only be seen in a microscope. But bacteria are very important to all life forms. Some bacteria can cause disease, even death. But other bacteria support the health of humans, plants and animals.

Case study

Species that have more genetic diversity are more adaptable and are more likely to survive problems. In the 1800s, potatoes were the most important part of the diet for the Irish people. Most farmers grew only one species of potato - the "lumper" potato species. In the 1840s, the lumper potatoes were attacked by potato disease which killed almost all the lumper potato plants. Because potatoes were a major part of the diet, many people starved to death – it is estimated that 1 out of 8 Irish people died of starvation during the 3 years of the potato disease. If there were different species of potatoes, some potato plants probably would have survived. This meant there would have been more food so fewer people would have died.

Activity: survey

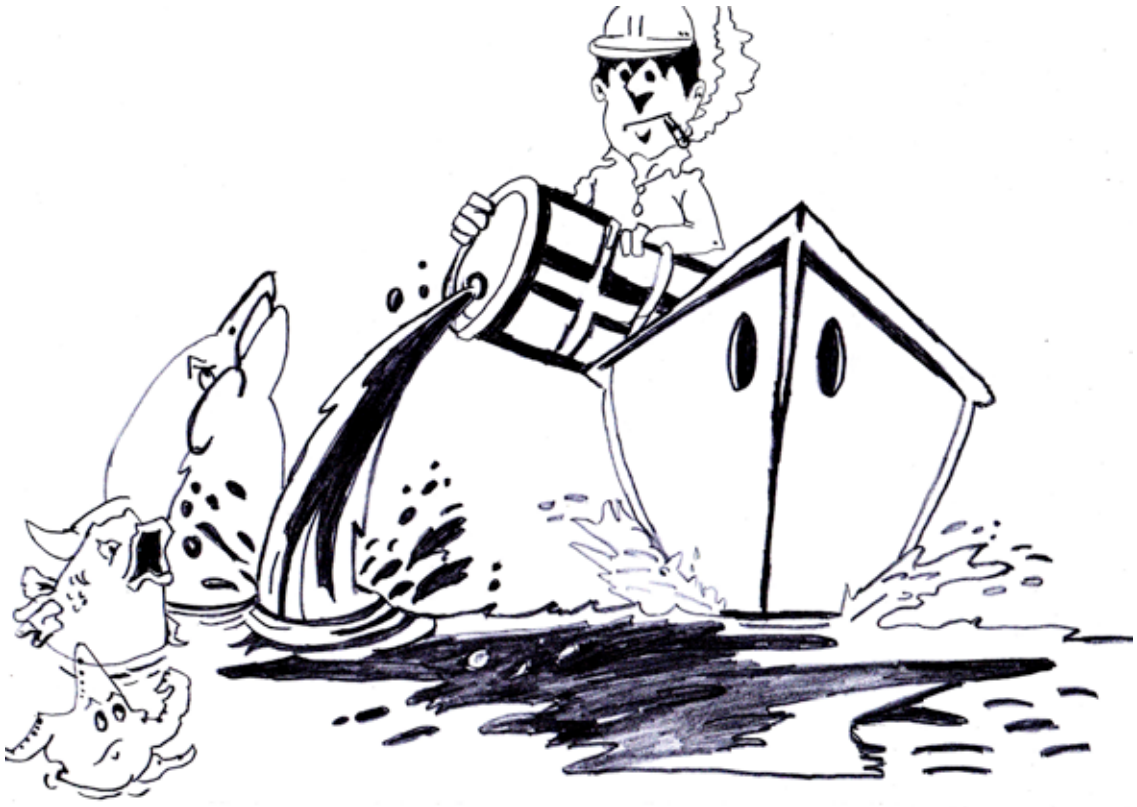
E **How many different kinds of trees grow in your area? In small groups collect a leaf from as many different types of trees as possible. Bring the leaves back to class and compare them with the leaves other groups collected. <u>Work in groups.</u>**

Reading

BIODIVERSITY IS BEING THREATENED

Unfortunately, biodiversity is declining all around the world. There are several important reasons for this:

1) **Global warming and climate change.**
2) **Habitat destruction and loss.** Humans are destroying the natural habitat in many ways, including clearing land to grow crops and build houses, flooding land by building dams, cutting down forests for wood, and clearing mangroves to build aquafarms.
3) **Habitat fragmentation** is when a large area of land is broken into little pieces; for example, by building roads and housing developments. This harms animals by forcing them to live in a smaller areas meaning (there is less food for those that remain) reducing genetic diversity, and increasing conflict between animals and people.
4) **Over killing or over fishing.**
5) **Pollution.**



Reading

BIODIVERSITY HOTSPOTS

A bioversity hotspot is an area that has lots of biodiversity and is in danger of losing this biodiversity through human interference. These are special areas, full of many different kinds of plants, birds, insects and animals. Some of these organisms are endangered, and will become extinct unless humans stop causing so much harm. Once an organism becomes extinct it is gone forever – it can never come back. Most biodiversity hotspots have two things in common: 1) they are located in moist tropical forests and 2) they include a range of different elevations from sea level to high mountains.

Myanmar is part of the **Indo-Burman Hotspot**, one of the 34 hotspots around the world. The Indo-Burman Hotspot includes almost all of Myanmar, Thailand, Laos, Cambodia and Vietnam plus a bit of China, India and Bangladesh.

Activity: survey

F **Work in pairs. Partner A looks at Extra # 1, Part A. Partner B looks at Extra # 1, Part B. Ask your partner to give you the missing information/numbers to complete the table.**

Species	Global Threat Status				Distribution by Country					
	Critically Endangered	Endangered	Vulnerable	**Total**	Cambodia	China	Lao PDR	Myanmar	Thailand	Vietnam
Mammals										
Birds										
Reptiles										
Amphibians										
Fishes										
Invertebrates										
Plants										
Total										

Case study

26 NEW SPECIES DISCOVERED IN MYANMAR

Twenty-six new species of life were recently discovered in Myanmar (2013). These species include 14 plants, 7 fish, 4 amphibians and 1 reptile.

Rhinopithecus strykeri, named in honor of Jon Stryker, president and founder of the Arcus Foundation, is the first snub-nosed monkey to be reported from Myanmar and is believed to be critically endangered. It is distinctive for its mostly black fur and white beard and for sneezing when it rains.

ENDANGERED SPECIES IN MYANMAR

Unfortunately, there are more than 400 endangered species of animals and plants in Myanmar including many species of coral, the Tonkin toad, tufted deer, Temminck's flying squirrel, the smooth coated otter, and the saltwater crocodile. Many of these plants and animals may become extinct unless people take steps to protect them.

Reflection

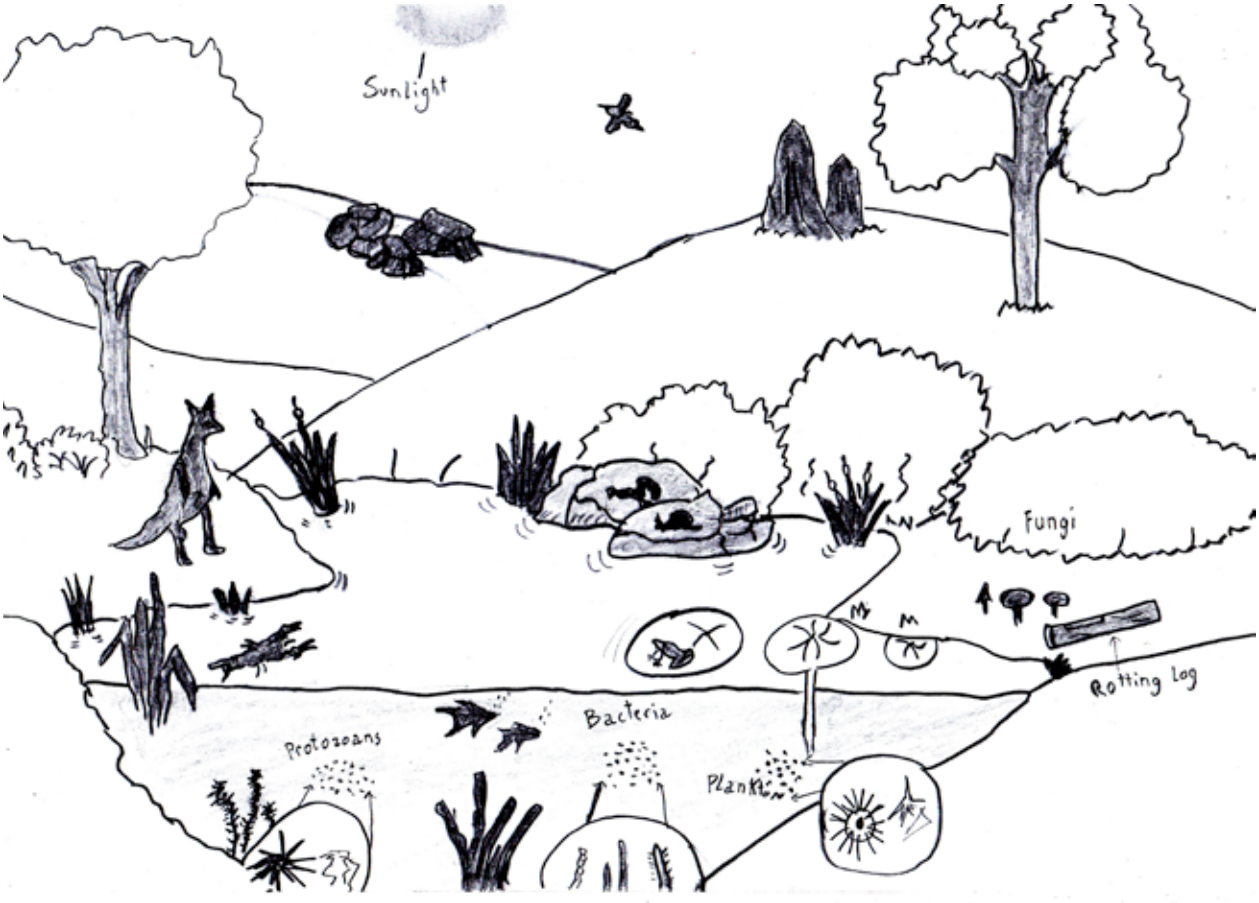
G Answer the questions below. <u>Discuss in groups then as a class.</u>

1) Is our area biodiverse? Why or why not?
2) Has the biodiversity of your area changed very much in the past 50 years? 25 years? 5 years?
3) What actions do you think you can do to help protect biodiversity in your area? In the rest of Myanmar?
4) The following are all threats to biodiversity in different parts of the world. How do these issues affect the biodiversity in your area? Rank them in order from least to most.

   a) A mine has destroyed and polluted the habitat
   b) There is a lot of illegal hunting
   c) A factory has polluted the land, air and water
   d) Mangroves were cleared for aqua farms
   e) Land has been cleared to build more houses
   f) New roads have been built
   g) An invasive species has eaten many animals
   h) Animals and/or plants have been harmed by disease

Additional Activity

Survey the biodiversity in your area and write a letter to your community leaders/council/ committee explaining the importance of biodiversity and the threats faced in your area. Then, suggest ways to conserve the biodiversity.



Lesson 4

Matter, Atoms and Molecules

What is matter?

Brainstorm

A **Brainstorm and answer the following questions. Work in small groups.**
1) What is water made of? 2) What is air made of? 3) What is soil made of?

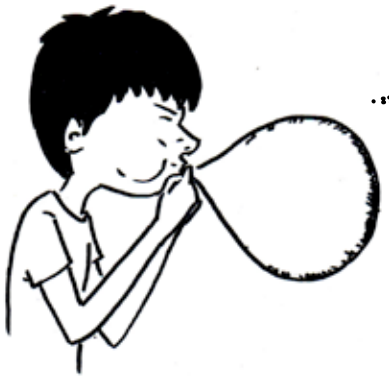
Reading

B **Read the text and answer the questions below. Work in pairs.**

Everything on earth, everything you can see, taste, touch or smell, from the air you breathe to the water you drink is made out of **matter.** Even you are made of matter. Matter is anything that takes up space and has **mass.** Though you cannot see or touch air, you can prove that it is matter by blowing up a balloon – there is something inside the balloon even though you cannot see it.

Vocabulary

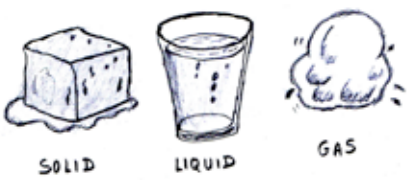
Mass is the amount of matter in an object (the amount of stuff a substance contains). In common language, mass means weight.



Even though you may not be able to see or touch or feel the air, you can prove it has mass by blowing the balloon

Matter can be in one of three states – solid, liquid or gas. All types of matter change from one state to another depending upon the temperature and the pressure applied. As the temperature gets hotter, solid matter (e.g. ice) melts into a liquid (water). If the temperature continues to rise the liquid will turn into a gas (water vapor). The opposite happens as the temperature gets colder. Gases condense into liquid and then freeze into a solid.

Some substances, such as water, easily change from one state to another. Other substances require extreme temperatures to change. For example, oxygen is usually a gas but it will freeze into a solid when you bring its temperature down to -219 degrees Celsius (219 degrees below zero).

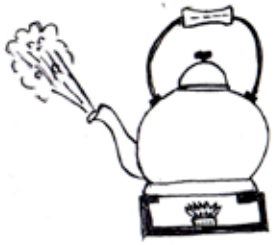


1) What form is water in at room temperature?
2) How does liquid water change into gas?
3) How does water vapor turn into liquid? How does this relate to rain?

Activity: experiment

C **Conduct the experiments below and note what you observe. <u>Work in small groups.</u>**

1) Experiment 1: Boil some water in a kettle. Notice the steam that rises when the water begins to boil. Place a plate over the steam and note what happens.



2) Experiment 2: Put a glass of ice water or a very cold bottle of soda or water on a desk or table. Note what happens outside the bottle.

Atoms and molecules

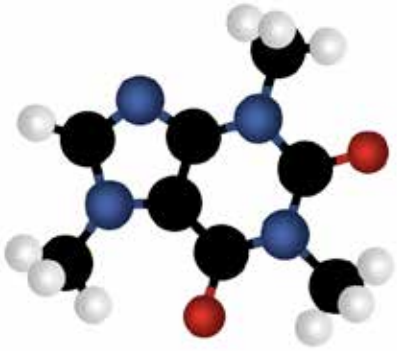
Reading

D **Read the text and answer the questions below. <u>Work in pairs.</u>**

All matter is made out of atoms. Atoms are the basic building blocks of matter- of you, water, air, salt, dirt and elephants. You can think of atoms like mud bricks. Bricks can be used to build a house factory, road or a wall.

Atoms are very, very tiny – about 100,000 times thinner than a human hair. They are made out of protons, neutrons and electrons. The protons and neutrons are packed together in the middle of the atom inside something called the nucleus. The electrons orbit around the outside of the atom. The rest of the atom is empty space. Every atom has the same number of electrons as it does of protons, but the number of neutrons can be different.

The amazing thing is that atoms are neither created nor destroyed. All atoms that are on earth now have been here since the beginning of time. Your toenail could be made of atoms that were once part of a dinosaur's eyelash or in the cup of tea your great grandmother drank 100 years ago.



How do you make a molecule?

Atoms join together to create molecules by sharing electrons. Molecules join together to create matter. Molecules are created and broken apart continuously through chemical processes. This releases the atoms so that they can form new molecules of a different substance. It is lucky for us that this happens, because we would soon run out of oxygen if trees and plants did not break down molecules of carbon dioxide, releasing the oxygen for us to breathe.

1) What are atoms?
2) How do atoms join together?
3) How do molecules break apart?

Elements and compounds

Reading

About 96 % of the human body is made up of just four elements: carbon, oxygen, nitrogen, and hydrogen.

Matter is either an element or a compound:

- An **element** is a pure substance, something made out of only one thing, one type of atom. Examples of common elements include Oxygen(O), Hydrogen (H), Helium (He), and Carbon (C). Only 92 different kinds of elements occur naturally on earth. Humans have produced at least 22 more elements. Every single thing that is on, above and inside our planet is made out of one of these elements or a combination of several different elements. What makes one element different from another is the number of protons contained in each atom. Every element has a different number of protons. Scientists have organized the elements into the periodic table (found in Extra #2).
- When two or more different kinds of elements combine they form a compound. Water (H2O), for example, is a compound made out of two gases: Hydrogen (H) and Oxygen (O).

A single element is like a letter in the alphabet – just as letters can be combined to form thousands of different words, single elements can be combined to form millions of different compounds.

Scientists have developed a way to write the chemical formula of different compounds. First is the letter(s) representing the element, and then a number representing the number of atoms of that element each molecule contains. For example: H2O is water. Each molecule contains 1 Hydrogen atom and 2 Oxygen atoms. But if you add one atom of Hydrogen to each molecule it becomes Hydrogen peroxide: H2O2.

Hydrogen + Hydrogen + Oxygen = H2O

Here are some common elements and the state they are in at room temperature.

Element	Symbol	State at room temperature (21C)
Carbon	C	Solid
Oxygen	O	Gas
Hydrogen	H	Gas

And here are some common compounds made of these elements.

Compound	Chemical formula	Made out of	State at room temperature (21C)
Propane	C3H8	Carbon and hydrogen	Gas
Carbon dioxide	CO2	Cabon and oxygen	Gas
Water	H2O	Oxygen and hydrogen	Liquid
Ethanol (alcohol)	C2H6O	Carbon, Oxygen and Hydrogen	Liquid

E **Refer to the text and the chart above and answer the questions below. <u>Work in pairs.</u>**

1) What is the difference between an element and a compound?
2) What makes one element different from another?
3) How many elements occur naturally on earth? How many have been created by humans?
4) How do you determine the atomic number of a substance?
5) When oxygen and carbon are combined, what compound do they form?

Organic versus inorganic matter

Reading

Matter is either organic or inorganic. Only compounds (not elements) are classified as organic or inorganic.

Organic matter is matter made out of the remains of living organisms. Molecules of organic material always contain carbon. In common language, organic means natural. Healthy soil contains lots of organic material such dead leaves. Plants grown in soil rich with organic material and are usually more nutritious than plants grown in soil with little organic material. Organic foods are grown with only natural fertilizers such as manure and compost. Many people believe that organic food is healthier than food grown with chemical fertilizers and pesticides. However, organic food is usually more expensive. Biofuel, which can be used to power cars and other vehicles, is a type of organic fuel made out of crops such as corn and sugar cane.

Everything that is not organic is inorganic. Inorganic matter can be natural or human made. All chemicals made in a laboratory are inorganic. Salts, metals and minerals such rubies and diamonds are inorganic as well. Only a few types of inorganic matter are made from molecules containing carbon. Examples include diamonds, carbon dioxide and carbon monoxide.

Activity: survey

F **Classify the items below as either organic or inorganic. Then, look around you, both inside and outside the room you are in, and add 8 other items in each column. <u>Work in pairs.</u>**

Biofuel, iron, rubies, leather, paper, salt, wooden table, air, glass, sugar, compost, a metal hammer

Organic Matter	Inorganic matter

Bio comes from the ancient Greek word bios which means life. Bio refers to anything that is or was alive.

	Word	Definition
1	Biology	The study of living organisms
2	Biodegradable	Something that can be decomposed by bacteria or another living organism
3	Biodversity	The variety of life in the world or a particular ecosystem
4	Biodynamic	A type of farming that uses only natural, organic fertilizer
5	Biohazard	Something biological that can harm the health of humans or the environment
6	Biomass	a) The total amount of living or recently living organisms in a given area b) A type of fuel made out of living or recently living organisms

Reflection

G **Do you think it is worth paying more money for organic food? Why or why not?**
Discuss as a class.

Chemical and physical changes

Reading

Matter is neither created nor destroyed but is always changing. Nothing, not even rocks and mountains, stay the same.

Changes are either physical or chemical. A **physical change** affects the size, shape, or form of a substance, but does not change what the substance is made out of. An ice cube melting into water is a physical change because the actual substance – water – stays the same. It just changes from one form to another.

A **chemical change** happens on a molecular level. Chemical changes create new substances.
A chemical change causes the molecules of a substance to break apart. This releases or frees the atoms contained in the molecule. These atoms can then join with other atoms to create new substances. Chemical changes make it possible for the same atom to be recycled again and again. This means that the same atom can form one substance today and then another substance next week and then another three years from now. Chemical changes include things like burning and digestion.

Exercise

H **Determine which of the following are physical changes and which are chemical changes.**
Work in pairs.

_____	Burning a piece of paper
_____	Ripping paper into tiny pieces
_____	Digesting food
_____	Dissolving sugar into water
_____	Baking a cake

Additional Activity

Prepare a short and simple presentation explaining the difference between organic matter/ food and inorganic matter/food and advocating your opinion on whether it's worth paying more money for organic food or not.

Lesson 5

Food Chains and Food Webs

Overview

Brainstorm

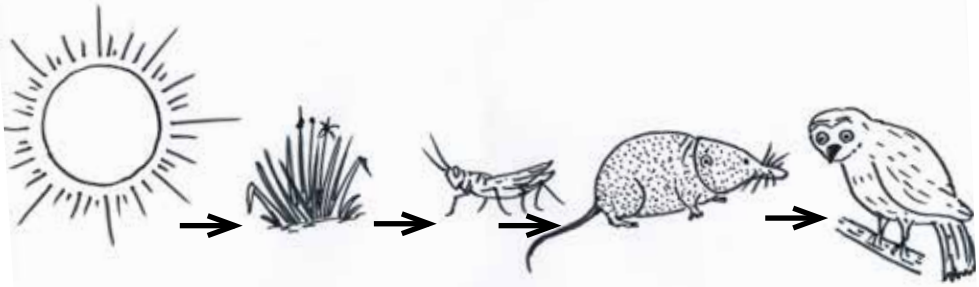
A **Brainstorm and answer the following questions. Work in small groups.**

1) Where does the energy you need to live come from?
2) Where does the energy that creates the food you eat come from?
3) What is the main difference between animals and plants?

Reading

A **food chain** shows the movement of energy and nutrients from one organism to another. Food chains are sequential, meaning that each link of the food chain follows another in order.
A **food web** is similar to a food chain as shows the movement of energy and nutrients from one organism to another. However, it is more complex in that it shows interconnected food chains that link all organisms in an ecosystem together in a huge web or network.

Example of a food chain:

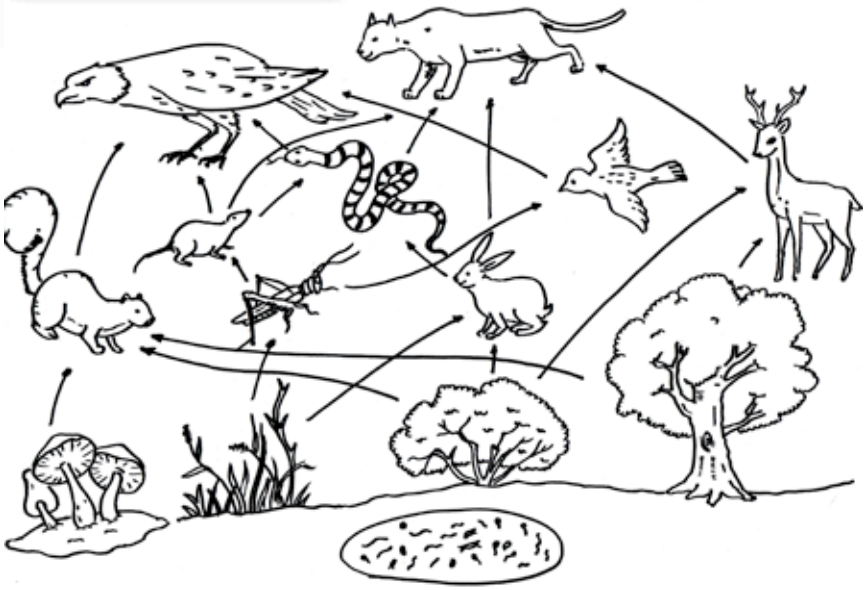


Exercise

B **Following the example above, list at least three food chains that can be found in your environment. Work in small groups.**

1)
2)
3)

Example of a food web:



Exercise

C **Following the example here, draw one simple food web that can be found in your environment. Work in small groups.**

Energy versus nutrient

Reading

All organisms need both energy and nutrients in order to survive. **Energy** is fuel, like gasoline for a car. Organisms use energy to grow and move and reproduce.

Almost all energy that fuels life on earth comes originally from the sun. Green plants and algae take energy directly from sunlight and use it to create their own food – **carbohydrates** - in a process called **photosynthesis**. The plant uses some carbohydrates to fuel its own growth and stores the rest.

Many organisms get most of their energy from carbohydrates, which break down into sugars. Humans, animals, birds and insects cannot make their own food. Instead, they must get energy by eating plants or by eating other living beings that eat plants.

In addition to energy, all living organisms need **nutrients**. All organisms including plants and humans will get sick and may die if they do not get enough of the right kind of nutrients.

Even though plants can create their own food, they still need additional nutrients to grow properly. They get these nutrients from the soil.

Important nutrients for plants include phosphorus, nitrogen and potassium. Therefore these three minerals are the key ingredients of most fertilizers. Humans also need these three nutrients, which we get by eating plants. Humans need additional nutrients including calcium, used to build strong bones and teeth, potassium, used to maintain healthy blood pressure, and Vitamin A, used to protect eyesight. Water is an essential nutrient that all organisms need.

Vocabulary

Energy: the capacity or strength needed to sustain an activity

Nutrient: Nutrients are substances that organisms need to function properly

What do you notice about the word **carbohydrate**? What elements do you think it is made out of? If you guessed **carbon** and **hydrogen** you are correct. Plants are able to take hydrogen atoms from water and carbon atoms from carbon dioxide and combine them into carbohydrates.

<u>Energy is used up or lost</u>

Much of the sun's energy is used up and lost as it moves from one organism to another. Energy is lost as heat and when an organism moves or grows. Energy is replaced by the sun.

<u>But nutrients are not</u>

Do you remember from Lesson 4 that matter is neither created nor destroyed? Atoms and molecules that make up matter are constantly being **recycled.** Molecules break apart, move around and create new substances.
In contrast to energy, the nutrients are not lost as they move along the food chain but are turned into new substances. You will learn more about how this happens in Lesson 6 – The Earth's Cycles.

Reflection

D **Think about how you feel when you miss a meal? How do you feel when you don't eat properly (amount or kind of food). <u>Work in pairs.</u>**

Levels in food chains

Reading

There are three major levels in all food chains. All food chains begin with **producers**. Producers are green plants that capture energy from the sun and convert it into energy in the form of food during photosynthesis. This energy is passed on when an animal, insect or bird eats the plant. In the next level of the food chain are the **consumers**. These organisms cannot create their own food but must get it by eating a plant or another animal. There are three levels of consumers:

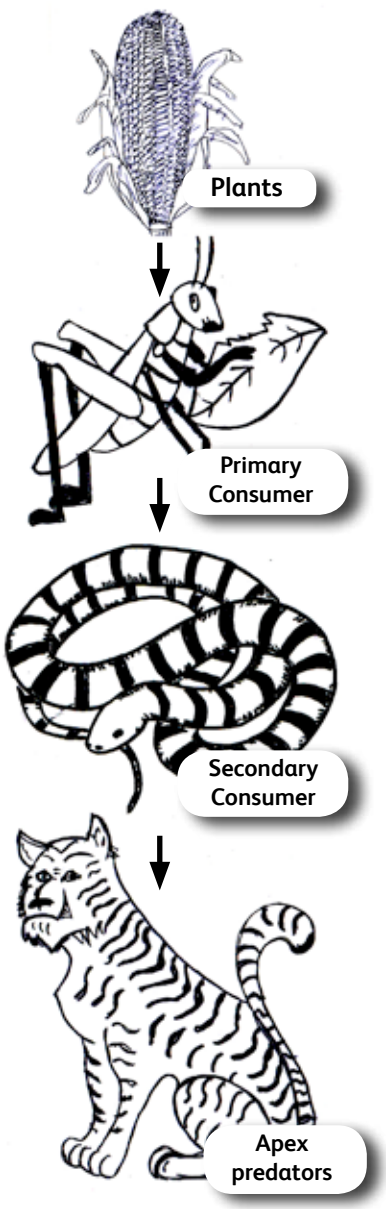
- **Primary consumers** (herbivores) get their energy from eating plants.
- **Secondary consumers** (carnivores or omnivores) get their energy from eating animals that eat plants.
- **Apex predators** (carnivores or omnivores) – Also called alpha predators or super predators, are animals that no other animal eats. They are at the very top of the food chain.

Vocabulary

Herbivores: animals which eat only plants. Grasshoppers, cows, water buffalos, deer and elephants are examples of Herbivores.

Carnivores: animals that eat only meat. Sharks, eagles, tigers and lions are examples of Carnivores.

Omnivores: creatures which eat both plants and animals. Humans, bears, rats, and crows are examples of Omnivores.



All carnivores are **predators**, meaning that they kill and eat other organisms. **Prey** are the living beings that are eaten.

The last link of the food chain is the **decomposers.** Most decomposers live in the soil or in dead trees. You can see some decomposers such as worms, fungus (mushrooms), slugs and snails. But bacteria, tiny organisms too small to see without a microscope, are the most important decomposers. Decomposers get their nutrients and energy from eating – or breaking apart - manure, dead plants and animals. By doing so, they release nutrients stored in the dead plant or animal and return them to the soil. The producers (plants) then absorb the nutrients through their roots and the cycle begins all over again.

Decomposers turn what most organisms consider waste into usable nutrients. If you die, decomposers eat you. If you poop, they eat that. If a tree loses a leaf, they eat it. Whenever something that was alive dies, the decomposers get it.

Exercise

E **List some animals that are both predator and prey. <u>Work in pairs.</u>**
For example: frogs (they eat insects and are eaten by hawks and snakes)

Activity: observation

F **Go to the closest potted plant, garden, or forest, look under the leaves and into the soil and survey all the decomposers you find. Work in small groups.**

Activity

G **Place each organism in the right category. Then add other organisms. Work in small groups.**

Frog	Snake	Eagle	Tiger	Spider	Shrimp
Caterpillar	Worm	Buffalo	Mouse	Banana leaf	Algae
Rice	Pig	Bacteria	Human	Ant	Fish
Rabbit	Teak tree	Mushroom	Grasshopper	Corn	Lion

Producers	Primary consumers	Secondary consumers	Apex predators	Decomposers

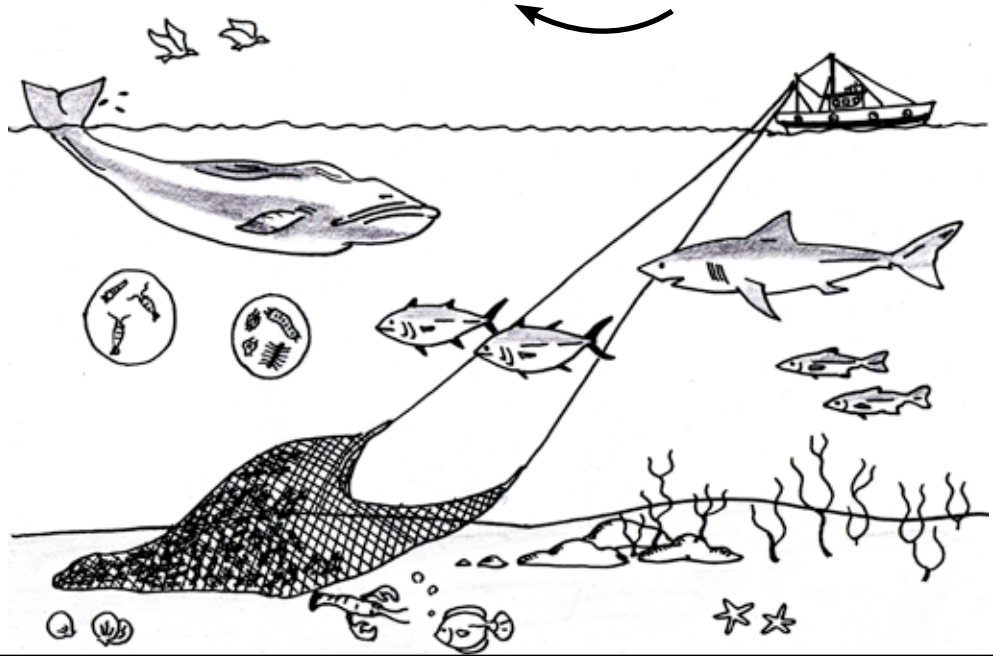
H **Arrange these organisms into 5 food chains. Work in small groups.**

I **Arrange these organisms into a single food web. Work as a class.**
Note: There are more connections in the food web than there are in the food chain.

Producers are plants that are able to make their own food by capturing energy from the sun. All food chains begin with a producer.

Consumers cannot create their own food. Instead they get the energy and nutrients they need by eating plants or organisms that eat plants.

Decomposers are organisms that get their energy and nutrients by eating dead consumers and producers. Decomposers complete the food chain, returning essential molecules to the producers. Capturing energy from the sun. All food chains begin with a producer.



Role of decomposers

The decomposers complete the system, returning essential molecules to the producers

Reflection

J **Reflect and answer the questions. <u>Work in small groups.</u>**

1) What would the world be like, if there were no decomposers?

Composting instead of burning!

As the decomposers munch away on dead organic matter including leaves, stalks and stems they create very valuable nutrients. These nutrients can be used to feed a new crop of plants. When plants are burned, much of the energy and nutrients the plant contains is lost as heat energy. Burning also adds pollution to the atmosphere. So instead of burning plant leaves, stalks and other parts, pile them in a big heap. Bacteria and other decomposers will break the plant parts down, and in doing so, will release lots of nutrients, excellent food for new plants. You can then work this compost back into the soil in a new field to give new plants valuable food.

Mind-map

K **Mind map the usefulness of composting. <u>Work in small group.</u>**

The importance of bacteria

Bacteria plays a very important role all along the food chain.

Bacteria are decomposers. Trillions of trillions of bacteria live in the ocean, in the soil, and in the atmosphere. Bacteria grow on dead creatures, but they also live inside you and every other living organism. Though some bacteria can make you sick, "good" bacteria help you and other animals digest food and stay healthy. You have billions of bacteria living in your intestine. They help break apart the food you eat so that you can use the nutrients contained in the food.

If all the bacteria living inside you died you would probably die as well.

Scientists estimate that there are five million trillion trillion bacteria on earth - 5000000000000000000000000000000

Factors affecting food webs

A food web can be misbalanced and changed due to various factors such as lack or absence of bacteria. Another example is the loss of a top predator. Top predators such as lions, wolves, and eagles help to keep ecosystems in balance by eating herbivores. When most top predators in an ecosystem are killed off, the ecosystem gets out of balance.

Exercise

L **Remember the case study of the wolves in Yellowstone National Park in the USA? What happened when the wolves were killed off?**

Case study

What Happens When a Chemical is Added to the Food Web?

To explain the true impacts of chemicals on the food web, we're going to use the real world example of mercury poisoning.
Coal-fired power plants burn coal and release mercury into the atmosphere as a **byproduct.** Over time, mercury falls to Earth through rain, snow and natural settling. Rain carries the mercury to streams and rivers and it eventually settles in lakes and ponds. After mercury enters lakes and ponds, bacteria transform mercury into a more easily absorbed toxic substance called Methylmercury. Aquatic plants, bacteria and plankton absorb Methylmercury from the surrounding water.
It's at this point that mercury becomes added to the food web. Eventually, the contaminated plants, bacteria and plankton will be eaten by predators, such as fish. The Methylmercury toxins will move into the tissues of the fish and poison a new level of the food web.

Magnifying Up the Food Web

Individual plants, plankton and bacteria only have a small amount of Methylmercury. The problem begins at the next level of the food web. Fish don't eat just one plankton or plant – they can eat hundreds or thousands of them! All the mercury in each of the plankton or plants has now been eaten by a fish and absorbed into the fat and tissues. After eating 100 planktons, the amount of Methylmercury in the fish is now 100 times of what it was in the plankton!
It doesn't stop there. The higher and higher up the food chain you go, the more food is necessary to maintain energy and activity. If a small fish eats 50 mercury contaminated plants, a large fish might eat 100 small fish, and an eagle or a human eats 100 large fish.
50X100X100 = 500,000 = The concentration of mercury in the eagle or human is 500,000 times larger than it was in the plankton!!
The process that causes the concentration of a substance to increase as it moves up the food web is called bioaccumulation. Methylmercury is a famous example of bioaccumulation, because mercury poisoning causes neurological disorders, reduced reproduction and even death in raptors and mammals. People are susceptible to mercury poisoning by eating too much contaminated fish.

Adapted from: https://www.nwf.org/Wildlife/Wildlife-Conservation/Food-Webs.aspx

Reflection

M **Answer the question individually. Share with your partner and then discuss as a class.**

1) Why are bacteria so important to you and your environment?
2) What is the major difference between the movement of energy and nutrients between organisms?

Additional Activity

Research online or in the library for types of organisms living in the different biomes and draw a food web that can be found in each biome.

Lesson 6

Earth's Cycles

Major cycles on earth

Remember that the smallest parts of matter – atoms – are neither created nor destroyed. Instead, molecules are continuously breaking apart, releasing the atoms to rejoin and form new molecules, which creates new kinds of matter. This happens through a variety of different cycles, including the carbon, oxygen, and nitrogen cycles.

The water cycle

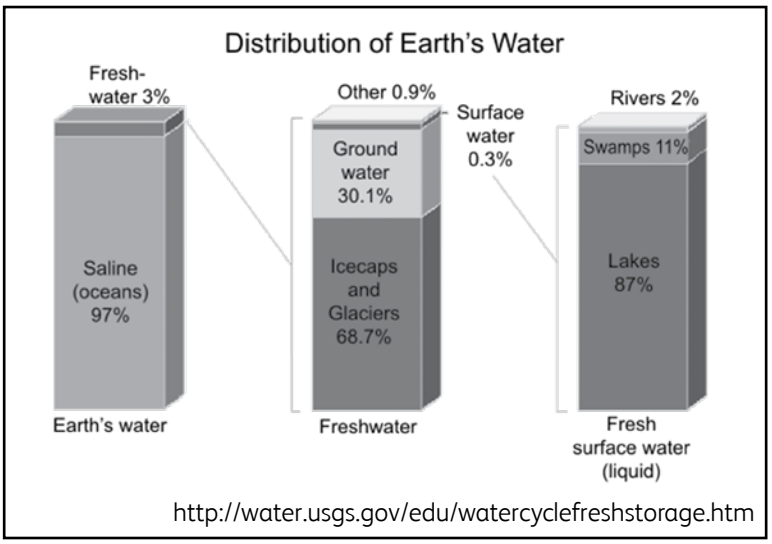
Brainstorm

A **Brainstorm and answer the following questions. <u>Work in small groups.</u>**

1) In what form does water exist?
2) Where can it be found and how does it travel?

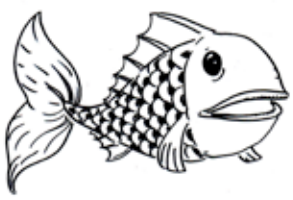
Activity

B **Look at the following chart and answer the questions. <u>Work in pairs.</u>**



Note: The 0.9 % of water counted as other refers to water that exists as water vapor in the air or water that is in the soil and thus not accessible by humans.

1) Where is most of earth's water located?
2) Where is most of the earth's fresh water located?
3) How much water is fresh water on the surface?



Fill a large glass of water and take a small sip. The water you just drank represents about how much fresh water exists on earth. All the water that remains in your glass represents salt water.

Reading

Most of the water (H20) on earth – about 97 % is salty ocean water. Only 3 % of earth's water is fresh water. Most of this fresh water is frozen in glaciers and ice caps (though these are melting rapidly due to global warming). Only about 1 % of all water on earth is usable by humans. Most of this usable water is stored underground. Only a tiny percentage of earth's water exists in lakes and rivers.

The total amount of water on earth is always the same, but water molecules are constantly moving around the world and changing form from liquid to gas (water vapor) to solid (ice). The process of moving the water and changing its form is called the **water cycle.**

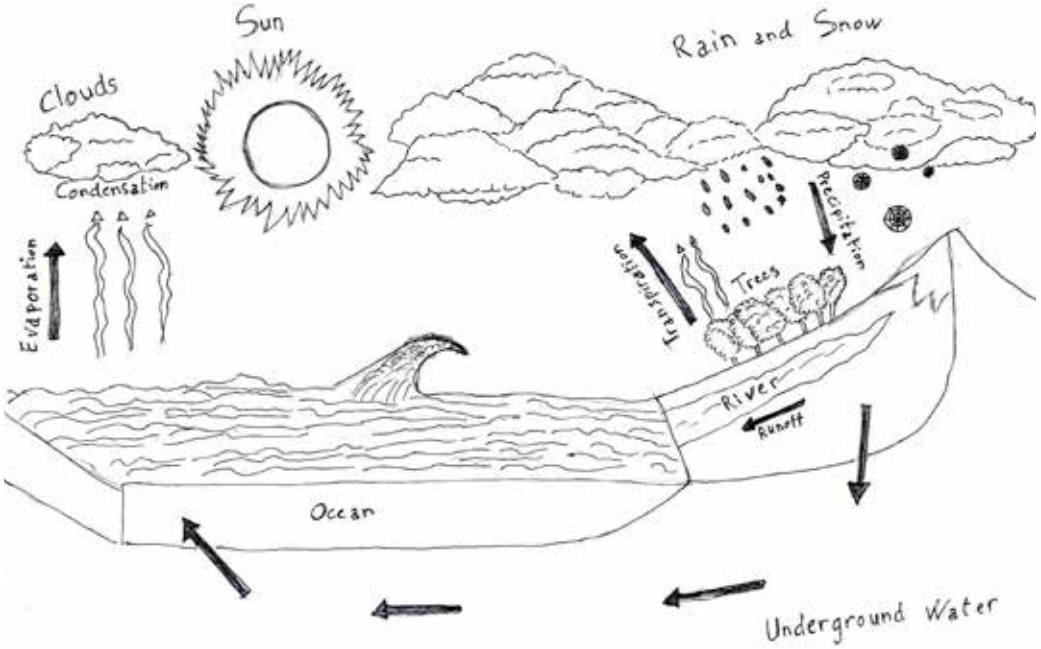
Here are the main steps of the water cycle.

- Energy from the sun makes water in oceans, lakes and rivers **evaporate**, meaning that liquid water is turned into a gas called water vapor.
- The water vapor rises up into the atmosphere until it cools and **condenses** into clouds.
- The water vapor becomes a liquid or solid and falls back to earth as rain, snow or hail. Once water falls to earth there are a variety of different things that can happen to it:
  - Most water falls into the ocean, where it will evaporate and rise up into the atmosphere once again.
  - Some falls into rivers and lakes. Much of this water evaporates or flows into the ocean.
  - Some is drunk by animals and humans. And a lot of this fresh water is used by humans for irrigation – about 70 % of all accessible fresh water used by humans is used for irrigation.
  - Water that falls on earth:
    - Is absorbed by the roots of plants
    - Sinks deep down into underground reservoirs
    - Becomes runoff water. Runoff water is water that is not absorbed into the earth. This can cause flooding and erosion. Runoff happens naturally when a lot of rain falls too quickly or in places where the land is very steep. Human development is also causing increased run off. Deforestation increases runoff as do things humans build such as roads and parking lots.
  - Underground water may be pumped back to the surface through wells and used for drinking, washing or irrigation. Or it may naturally be released through springs.

Discussion

Discuss and answer the questions. <u>Work in groups.</u>

1) What steps of the water cycle can you observe in your area?
2) How does water quantity in your nearby river or lake change throughout the year?
3) How do you access water in your area?
4) What affects the quality of this water?



The carbon cycle

Reading

Carbon is the main building block of life. All living things on earth, both plants and animals, contain carbon and need a continuous supply of carbon to survive. The human body is about 18 % carbon and carbon is found in almost every cell in our body. Carbon is also found in some nonliving things, including diamonds, graphite and plastic. All carbon atoms that are here now were here when the earth began billions of years ago. But carbon atoms are constantly moving and changing form in a complex process called the **carbon cycle.** Carbon changes from gas to solid and back to gas as it moves from the atmosphere to the oceans, from plants to animals, and from living things to non-living things.
Here are the major parts of the carbon cycle:

- Carbon moves from the atmosphere to plants: Plants, both on land and in the sea, absorb carbon dioxide (CO_2) from the atmosphere. Plants use energy from the sun to separate carbon atoms from oxygen atoms. The oxygen is released back into the atmosphere and the plant converts the carbon into sugars, which is as food.
- Carbon moves from plants to humans and animals: Humans and animals get carbon from eating plants (or from eating animals that eat plants)
- Carbon moves from animals and humans to the atmosphere: Humans and other animals release carbon in the form of carbon dioxide when they breathe.
- Carbon moves from plants and animals to the ground: When plants and animals die the carbon in their bodies is released into the ground.
- Carbon moves from the soil to the air: Tiny organisms called microorganisms create carbon dioxide by combining carbon atoms with oxygen atoms. When soil is turned over this carbon dioxide is released back into the atmosphere. Carbon can also be released into the atmosphere during a volcanic eruption.
- Carbon moves from fossil fuels to the atmosphere: When fossil fuels such as coal, oil and kerosene are burned to power factories, vehicles or cook stoves, carbon is released into the atmosphere as carbon dioxide. About 5.5 billion tons of carbon is put into the atmosphere each year by burning fossil fuels. This is one of the main causes of climate change and global warming.
- Carbon moves from the atmosphere into the oceans: Much of the carbon dioxide (CO_2) released into the air is later absorbed by the ocean. In recent years, the ocean has been absorbing too much CO_2. High levels of CO_2 are causing the ocean to become more and more acidic, which is harmful to marine life. More than 3 trillion tons of carbon dioxide (CO_2) exists in the atmosphere.

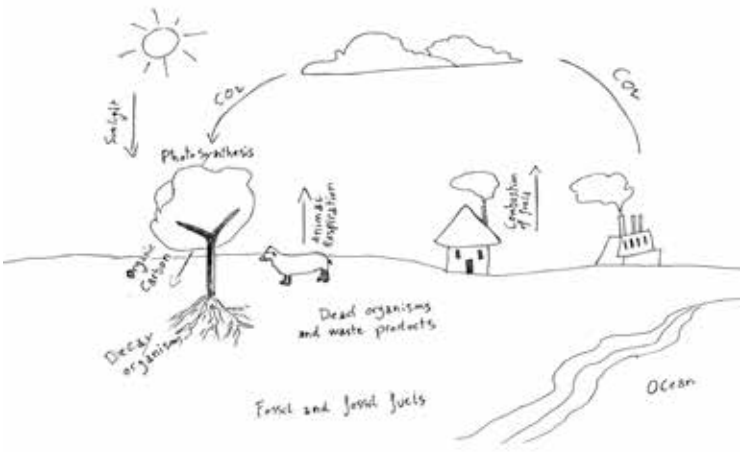
Discussion

D **Discuss and answer the questions. Work in groups.**

1) What would happen if all the plants on earth died?
2) Why do fossil fuels release CO_2 into the atmosphere when they are burned?
3) How has human activity added more CO_2 to the atmosphere?
4) Why is too much CO_2 harmful for the environment?

Activity

E **Many millions of years ago a particular carbon atom was in the bone of a dinosaur. Today the same carbon atom is in your eye lash.**
Using pictures and words show how this carbon could have changed form and location to move from the dinosaur to you. Describe at least five different steps. Work in pairs.



The nitrogen cycle

Reading

Like oxygen and carbon, living things also need nitrogen to survive. Plants use nitrogen to create stems, leaves, flowers and seeds. In humans and animals, nitrogen is an important part of amino acids, which are the basic building blocks of the proteins in our hair, muscles, and skin. Nitrogen is also an important part of our DNA. About 80 % of earth's atmosphere is made up of nitrogen, making nitrogen the most common gas on our planet. But most living creatures cannot take in nitrogen gas directly from the atmosphere.

The nitrogen cycle converts nitrogen into different states so that it can be absorbed by different organisms. It also moves nitrogen between the atmosphere, soil, plants and animals.

- Plants get their nitrogen from the soil. Bacteria in the soil converts or fixes nitrogen into a form that plants can absorb. Most of these bacteria live on the roots of legumes such as peas, lentils and soybeans.
- Humans and animals get nitrogen from plants. Even carnivores such as tigers get nitrogen indirectly from plants, since the animals they eat contain nitrogen that originally came from plants.
- Nitrogen is returned to the earth when the plant dies or when animals defecate.

Since nitrogen stimulates plant growth it is often used in chemical fertilizers. This causes problems when excess nitrogen flows into lakes, rivers and ultimately the ocean. The excess nitrogen causes algae and other aquatic plants to grow too much. These plants can block the sun from deeper water, killing fish and causing other problems.

Organic farming methods are better for the environment because they don't use chemicals, which can be harmful to the environment.
There are two organic methods farmers use to add nitrogen to the soil.
1. They plant a crop of legumes (peas, soybeans, lentils) as part of crop rotation, since legumes add more nitrogen to the soil
2. There is also a lot of nitrogen in animal manure and urine, which is often used to fertilize crops organically.

Discussion

F **Discuss and answer the questions. Work in groups.**

1) Describe the significance of legumes in the global nitrogen cycle.
2) How can farmers return nitrogen to the soil?
3) What is the importance of the nitrogen cycle?
4) How do human activities affect the nitrogen cycle?

The oxygen cycle

Activity: experiment

G **Try this experiment.** Work in small groups.

Light a candle, let it burn for a few moments and then cover it with a glass turned upside down. Observe what happens.

Learning the oxygen cycle will help you understand why oxygen is so important

Reading

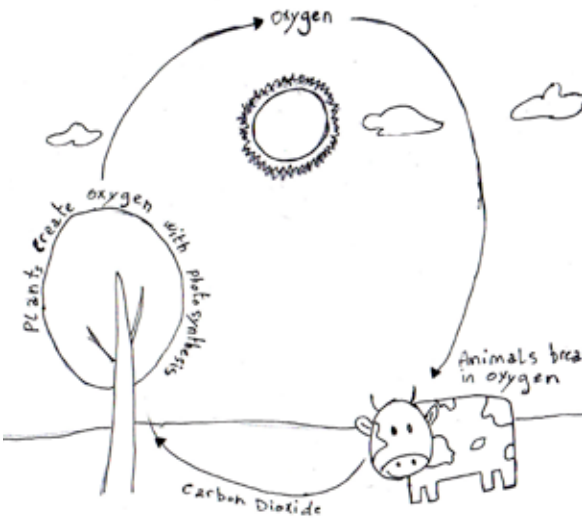
Most of you is oxygen! And most of this oxygen is in the form of water (H20). About 65 % of your body is water. Oxygen is the most common element on earth. All animals need oxygen to survive and the earth is the only planet in our solar system with enough oxygen to sustain life. Though most often thought of as a gas, oxygen can also be solid or liquid. Oxygen makes up about 30 % of the earth's crust and 20 % of the earth's atmosphere. Oxygen plays a very important role in the atmosphere when it is in the form of O3, otherwise known as ozone. The ozone layer helps to protect life on earth by blocking some of the sun's harmful UV rays. Unfortunately, the ozone layer is being damaged by a variety of chemicals made by humans.

The **oxygen cycle** is closely linked with the carbon cycle. Plants absorb carbon dioxide (C02) from the air. Using energy from the sun, plants split oxygen atoms from carbon atoms during photosynthesis. They use the carbon to make carbohydrates for food. The oxygen is mostly a waste product to the plants so they release it back to the atmosphere. That's great for us and for most animals on earth, including fish, as we need this oxygen to survive. Our cells use oxygen to burn food and produce energy.

These processes release oxygen:

- **Respiration** – Humans and animals use oxygen during the process of respiration, otherwise known as breathing. Fish breathe oxygen that has been dissolved in water through their gills.
- **Decomposition** - When plants and animals die they decompose (rot, decay) and this process uses oxygen.
- **Combustion** – Oxygen is also needed to make something burn in a process called combustion. Without oxygen nothing can burn.

Most of the oxygen we breathe comes from ocean plants, called phytoplankton. Trees growing in the Amazon Rainforest provide about 20 % of the earth's oxygen



Discussion

H **Answer the questions. <u>Work in pairs.</u>**

1) Why do you run out of breath when you exercise hard?
2) Where does most of the oxygen you breathe come from?
3) What is the purpose of the Ozone layer?

Additional Activity

Follow the instructions by your teacher and build your mini water cycle.

Lesson 7

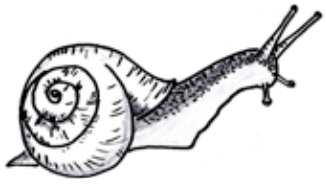
Natural Resources

What are natural Resources?

Brainstorm

A **Brainstorm and answer the following questions. <u>Work in groups.</u>**

1) What are natural resources?
2) Water is one of the most important natural resources. What are some others? List at least 10 natural resources.



A natural resource is something in nature that people can use. People do not make natural resources, but gather them from the earth. Natural resources:

1) Exist naturally in the environment
2) Are required for human survival or are useful to humans in some way

Exercise

B **Classify the following items then answer the question below. <u>Work in pairs.</u>**

Mosquitoes	Fish	Teak trees	Plastic	Copper
Land	Coal	Cars	Worms	Soil
Solar power	Petroleum	Firewood	Paper	Stainless steel
Shrimp	Diamonds	Wind	Iron	Glass

Not a natural resource	Natural Resource

1) Why are the items in the first column not considered to be natural resources?

Classifying natural resources

Reading

There are several ways of classifying natural resources.

1) Natural resources can be biotic or abiotic

- **Biotic** natural resources are those that come from living organisms such as trees, plants, animals or fish. Fossil fuels - coal, natural gas and oil – are biotic natural resources since they come from plants that died millions of years ago.
- **Abiotic** natural resources are those that come from non-living sources. These include land, sunlight,air, water, minerals (such as silver, tin, and iron) and gems (such as rubies and diamonds).

C **Complete the table below and list at least 5 biotic and 5 abiotic natural resources. <u>Work in pairs.</u>**

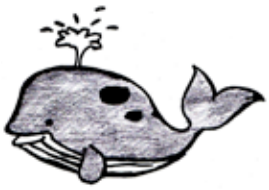
Biotic	Abiotic

2) Natural resources can be renewable or nonrenewable

- **Renewable natural resources:** The name says it all – these are resources that can **re-new** themselves. Renewable resources can replenish or replace themselves fairly quickly after they are used. Or they are resources that can never be used up. There are two types:

Plentiful: These natural resources are always available and are not affected by human consumption. Plentiful natural resources will never run out. Examples include sunlight, wind and air.

Although air will never run out, it can become polluted or contaminated by toxins. We must treat this resource carefully.



Limited: These resources can come back. However, if they are not used wisely, they could be used up and disappear. Examples include wild fish, fresh water, and forests.

- **Non-renewable** – these are natural resources that take millions of years to make. They are used faster than they can be replaced and eventually will be used up. Fossil fuels and diamonds are an example of non-renewable natural resources.

Question: What are fossil fuels?

D **Complete the table below and list at least 5 items in each column. <u>Work in pairs.</u>**
Refer to the list of natural resources at the end of the book or think of your own

Renewable: Limited	Renewable: Plentiful	Nowrenewable

3) Natural resources can be global, national, or multinational

- **Global** natural resources are found all over the world and cannot be owned by one nation. Examples include air, wind, and sunlight.
- **National** natural resources are found entirely within the boundaries of one country. Crude oil is one of the most important national resources and can bring great wealth to individual countries. Sometimes countries go to war in order to get control of natural resources owned by another country.
- **Multinational** natural resources cross international boundaries, such as rivers.

Rivers are a multinational resource because they often begin in one country but flow through other countries. Problems and conflict occur when countries near the top of the river dam the river or divert it for irrigation.

E **Answer the following questions. <u>Work in small groups.</u>**

1) What natural resource has made many countries in the Middle East including Saudi Arabia, Kuwait and the United Arab Emirates very wealthy?
2) What are some of the most important natural resources in Myanmar?

Natural Resource Management

The air we breathe, the food we eat, the petrol we put in our cars, the water we drink, the wood and metal and cement we use to build our homes and schools and hospitals, are all made from natural resources.

If we do not use natural resources carefully they could be destroyed or used up entirely.

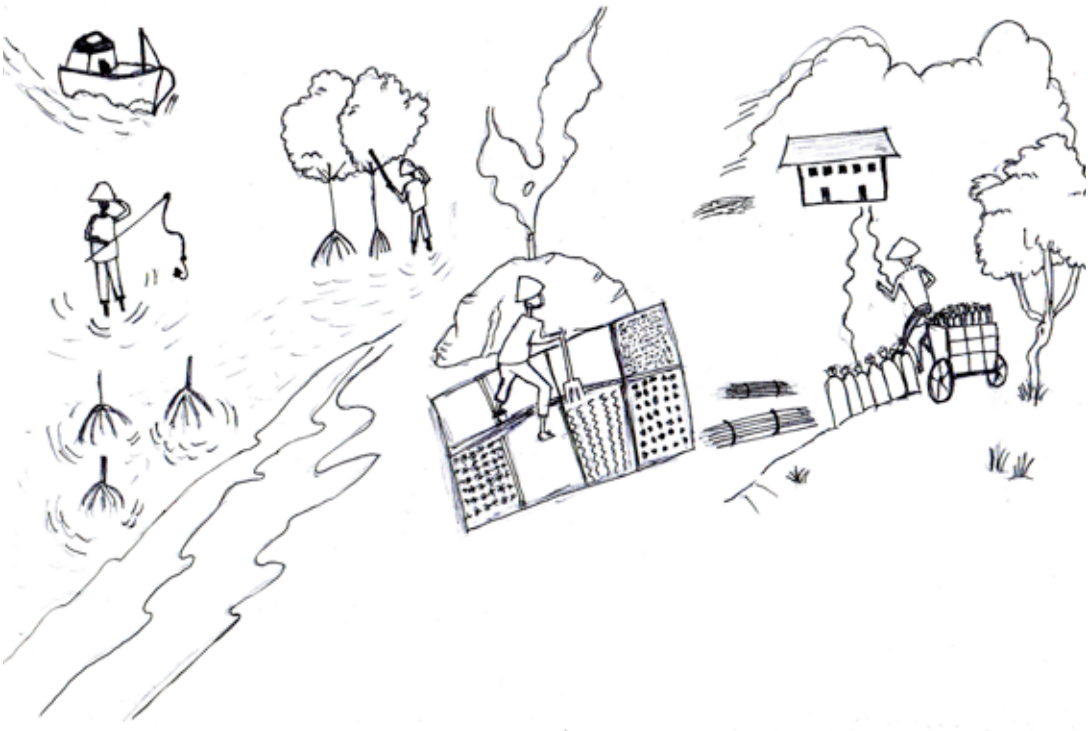
Natural resource management means using our natural resources such as land, water, soil, plants and animals wisely, sustainably and responsibly, so that these resources will benefit humans now and in the future

Effective natural resource management will help protect our existing natural resources so that they will last and future generations will be able to enjoy them as well.

Activity

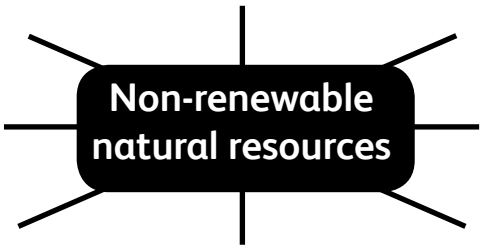
G Listen to the passages read by your teacher, and answer the following questions.

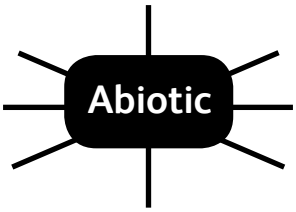
1) What is Natural Resource Management?



✳ *Mind-map*

G **Complete the following mind map. Do one about Myanmar and one about your community. <u>Work in groups.</u>**





Reflection

H **Think and answer the questions individually. Then, share with your partner and discuss as a class.**

1) How are natural resources managed in Myanmar?
2) How are natural resources managed in your community?
3) How can these resources be managed better?

Additional Activity

List all the items in your Room/ Kitchen or Classroom and name the natural Resources used to make each item. Then rank the items according to Main Resource type: Renewable limited, Renewable, plantiful or non-renewable.

Lesson 8

Energy

What is energy?

Brainstorm

A **Brainstorm and answer the following questions. <u>Work in pairs.</u>**

1) How do plants get their fuel?
2) What do people and animals use as fuel?
3) What do vehicles use for fuel?
4) What do phone and laptops use for energy?

Reading

Energy is the force that makes something change or move or grow. All living organisms, including plants, need energy to live. Cars and trains and planes need energy to move. Lights and computers, fridges and phones all need energy to work. We need energy to transport and cook our food. Energy is a very important part of life! Fuel is used to create energy and to store energy until it is used.

Electricity is a very important source of energy. It can be made from many different fuels including coal, oil, nuclear energy, sunlight, and moving water. Electricity is useful because it is easy to transport (through electric wires) and store (in batteries).

There are many different kinds of fuel. Many but not all fuels are made out of carbon.
Like other natural resources, energy:

- Is renewable or nonrenewable
  - **Renewable energy** is made from unlimited natural resources such as sunlight or natural resources that can be easily replenished such as bamboo.
  - **Non-renewable energy** is made from fuels that cannot be replenished in our lifetime. Fossil fuels are the major non-renewable fuel.

There are many different kinds of fuel, including the following:

1) Wood
2) Natural gas
3) Coal
4) Charcoal
5) Kerosene
6) Diesel
7) Garbage
8) Gasoline
9) Sunlight
10) Moving water
11) Wind energy
12) Geo-thermal
13) Dried animal manure
14) Methane gas made out of animal manure
15) Ethanol, a type of alcohol based fuel
16) Biodiesel (a fuel made out of vegetable oils and animal fats)

Even garbage can be used as a fuel! Sometimes garbage is burned and the heat is captured and turned into energy.

Non-renewable energy- Fossil fuels

Reading

Fossil fuels are so named because they come from the remains of plants and algae that died hundreds of millions of years ago. That's right – coal, oil and natural gas are made out of the remains of dead plants. Remember the carbon cycle? Plants take in carbon atoms from carbon dioxide gas in the atmosphere. They then use these carbon atoms to build their stems and leaves, their flowers and seeds. These carbon atoms never go away, even when the plant dies. Instead – over hundreds of millions of years – the carbon atoms change from plants into fossil fuels. When fossil fuels are burned, the carbon atoms are released back into the atmosphere and turn in carbon dioxide. Carbon dioxide harms our natural environment since it is one of the greenhouse gases that causes **global warming** and **climate change.**

Why are fossil fuels non-renewable?

Renewable energy

Reading

The energy sources listed below are renewable since they are made from unlimited natural resources. They are considered to be cleaner than fossil fuels as they do not release greenhouse gases when used or extracted from the earth. However, even though these sources are cleaner they can still cause environmental damage.

Solar energy (Fuel Source: Sunlight) Energy from the sun is captured by solar panels and turned into electric energy. This electricity is then sent to the electric grid or stored in batteries. Electricity stored in batteries can be used to power lights, laptops, phones, TVs and small appliances.	
Hydroelectric energy (Fuel Source: Rivers) Hydro power is a very old form of energy. These days, spinning wheels convert river energy into electricity. There are very small hydroelectric generators that can be placed in rivers to produce small amounts of energy. These cause very little environmental damage. However, most hydroelectric energy is made by building big dams across an entire river. The water is then forced through a small opening in the dam where it spins wheels that produce energy which is converted into electricity.	
Wind energy (Fuel Source: Wind energy) Large spinning turbines capture wind energy and convert it into electricity. Wind energy has one of lowest environmental impacts of all energy sources. However, the large turbines sometimes kill birds. Currently wind produces only about 1.5 % of all international electricity, but it is growing rapidly.	

Geothermal (Fuel Source: Energy from the center of the earth) Steam from very hot water deep inside the earth is captured and used to turn turbines which then create electricity. As of 2012, five countries (USA, Philippines, Indonesia, Mexico and Italy) produce most of their electricity from geothermal sources.	
Tidal power (Fuel Source: Ocean tides) As ocean tides rise and fall the moving water rotates generators under water which produce electricity. Tidal power has great potential for the size of oceans. However its availability is still limited for its high cost.	
Biofuels (Fuel Source: Living and recently dead biological matter) Biofuels - literally biological fuels - are created from plants and plant parts including sugarcane, corn, and wood chips. Ethanol is one of the most common biofuels. Biofuels are renewable and are cleaner than fossil fuels as they do not release as much carbon dioxide. However, biofuels might cause environmental damage since natural rain forests are cut down to grow corn and sugar cane.	
Nuclear energy (Fuel Source: Uranium and plutonium) Nuclear energy is created by splitting atoms of uranium and plutonium. This creates a huge amount of energy which is used to heat water to create steam which is then used to generate electricity. Currently there are 439 nuclear reactors operating in 31 countries. Nuclear energy does not produce carbon emissions so many people consider it to be a clean and renewable source of energy. However, it does produce radio-active waste which must be stored very carefully.	

★ *Exercise*

B **Refer to the chart above and list examples of renewable and non-renewable energy in the chart. <u>Work individually.</u>**

Renewable	Non-renewable energy

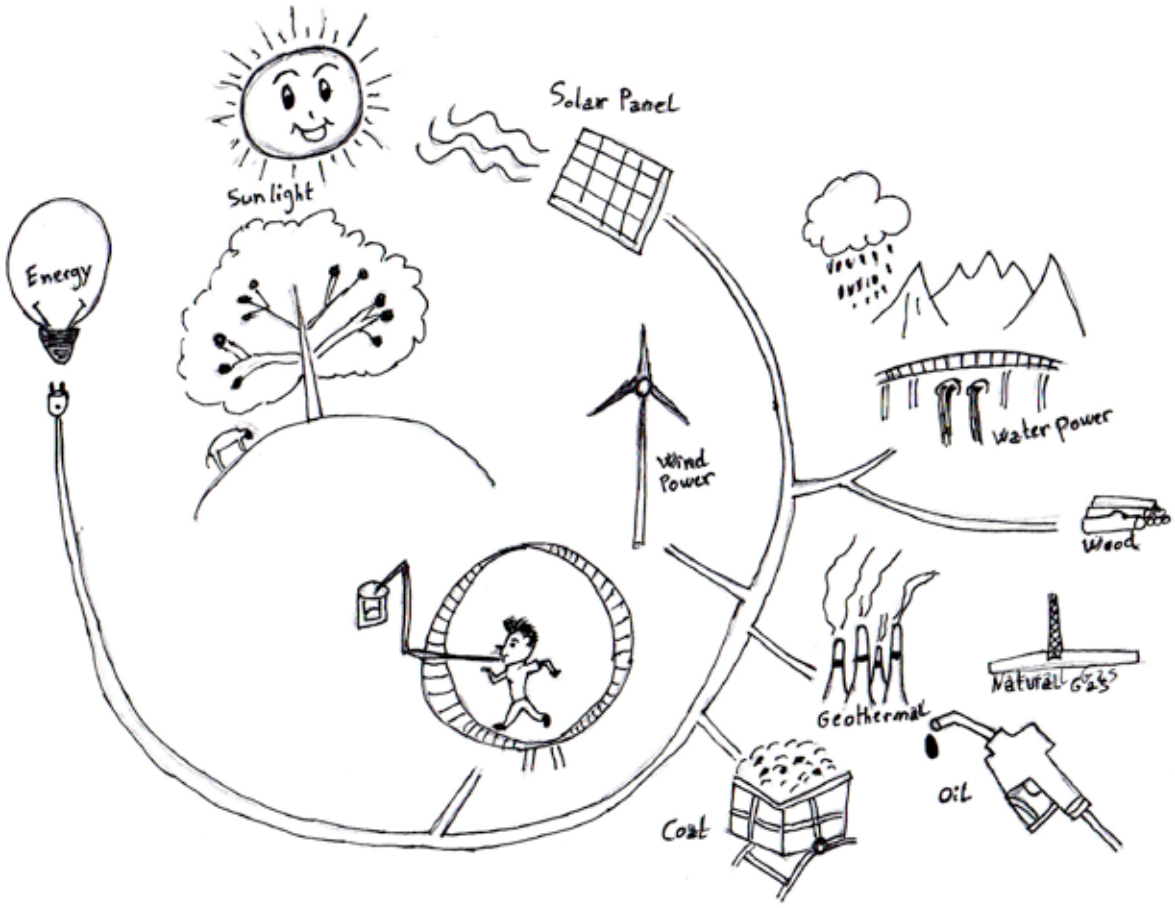
Discussion

C **Discuss your answer in groups.**

1) Which forms of energy do you use on a daily basis?
2) Which of the studied sources of energy have you never heard of before?
3) What does your household use to cook food?
4) Have you ever used solar power?
5) What do you think is the best source of energy for:
    a) Lighting your home
    b) Cooking
    c) Powering a vehicle

Additional Activity

- **Pick one of the studied examples of energy and imagine the scenario where the only energy available on earth is the energy you picked.**
- **Mind map the advantages, disadvantages and impact of the only use of that energy.**



Lesson 9

What is a Healthy Ecosystem?

Overview

Brainstorm

A **Brainstorm and answer the following questions. <u>Work in small groups.</u>**

1) How is the concept of an ecosystem different from a natural environment?
2) Provide 3 examples of very small ecosystems.
3) Provide 3 examples of large ecosystems.
4) List at least five ecosystems that can be found in your area.
5) What can you do to protect and promote the health of ecosystems in your area?
6) Why are healthy ecosystems important?

Why are healthy ecosystems important?

Reading

Our lives and the lives of all living organisms depend on healthy ecosystems! We do not live in isolation but in a **community** of other living organisms as well as nonliving elements such as water, air and soil. We are all **interconnected.** If one member of an ecosystem sickens or dies the health of the entire ecosystem may be affected. An ecosystem may also be changed by the addition of a new organism, especially an invasive species.

Among other reasons, healthy ecosystems are important because they:

1) Sustain the life of all organisms living in that ecosystem
2) Support biodiversity
3) Provide food, wood, clean water and other resources
4) Maintain good air, soil, and water quality
5) Protect us from natural disasters like erosion and floods
6) Help an area recover from natural disasters
7) Help maintain a stable climate
8) Promote healthy, fertile soil which helps produce more fertile crops
9) Provide aesthetic, social, cultural, recreational and spiritual benefits
10) Help reduce insect pest infestation

Discussion

B **What are the most important benefits of healthy ecosystems? Select three of the reasons listed and explain why you think each reason is especially important. <u>Work in groups.</u>**

What is a healthy ecosystem?

Reading

There are some important characteristics common to all healthy ecosystems.

A healthy ecosystem:

1) Provides for the needs of all organisms living within that ecosystem. What do all organisms need to survive? To survive and thrive, most organisms need:

- clean air
- clean water
- the right temperature
- enough sunlight
- enough quality food
- a balance of predators and prey
- suitable habitat

2) **Is biodiverse.** This means that there are many different species of plants, insects, animals, birds, and other organisms living in the ecosystem. A biodiverse ecosystem also has a lot of genetic diversity within a single type of organism. There are several reasons why biodiversity is an important ingredient of a healthy ecosystem:

   a) Biodiversity helps the entire ecosystem be more sustainable. A sustainable ecosystem is one that can survive and thrive, an ecosystem that supports itself without outside support or assistance. Biodiversity helps an ecosystem be sustainable because different species depend upon one another. If one particular species disappears from an ecosystem there can be a lot of environmental damage.

   b) Biodiverse ecosystems are stronger than ecosystems with limited biodiverstiy. They are better able to survive and recover from damage. This is true both in natural environments and in manmade environments such as farms. Disease, climate change or another problem may kill or damage one particular species, but not affect another similar species. If there are a wide variety of different species, some species will survive and the damage will be much less.

   c) Biodiversity helps ensure that an ecosystem stays well balanced

3) **Has mostly native, not invasive species.** Native species are living organisms that are originally from that ecosystem. They are well adapted to their environment and live in harmony with other organisms. Invasive species are those that move into an ecosystem from somewhere else and cause harm by killing native species or by consuming the space or resources (such as food) native species need to survive.

To protect the country from the negative effects of invasive species, some countries, particularly Australia and New Zealand, have very strict laws about what types of agricultural products you can bring into the country.

4) **Is sustainable.** A sustainable ecosystem will last as it is into the future without outside assistance. A sustainable ecosystem has all it needs to survive.
Biodiversity is one important factor sustainable ecosystems need, but other factors are needed as well. For example, sustainable ecosystems need the right kind of habitat for all organisms living in that ecosystem. If the habitat a particular species depends on disappears, that species will eventually disappear as well. For example, a polar bear needs thick ice to hunt seals. But due to global warming, polar ice is melting. The population of polar bears is declining as the habitat they needs melts.

5) **Is non-toxic.** A healthy ecosystem does not have harmful chemicals or poisons in the land, air or water. Some toxins are easy to see, while others are invisible. Tests need to be done to determine the levels of invisible toxins.

6) **Has apex predators.** Healthy ecosystems include top-level predators to keep the whole system in balance.

7) **Is in balance** – All the organisms in a healthy natural ecosystem are interconnected so that the whole system is in balance. There is not too much of one particular species.

8) **Is protected by concerned and informed citizens.** There are many factors damaging ecosystems around the world. Some include climate change, deforestation, mining, and population growth. It is up to people – including you! – to learn how to protect the environment and take steps to do so.

Discussion

C **Discuss and answer the following questions. <u>Work as class.</u>**

1) Why are biodiverse ecosystems stronger than ecosystems with little biodiversity?
2) Do you think poisonous snakes should be killed? Why or why not?
3) Are there poisons in your local ecosystems? In your air, water or soil? Explain.
4) How can you educate your local community about the importance of healthy ecosystems?

How can we promote and protect healthy ecosystems?

There are many things you can do, as individuals, communities and nations, to preserve and protect the health of the ecosystems around us.

Activity

D **Look at the two action categories below and complete the table by answering the questions.**

1) Don't cause harm

Don't do things that harm the natural environment. Here are five suggestions. Try to list five more.

1. Don't pollute 2. Don't overfish 3. Don't destory critical habitats 4. Don't kill off apex predators 5. Don't use more than necessary (from wood to water to plastic bags)	**List five more**

2) Actively help

Take action, take responsibility, and make a difference! You can take active steps to help sustain a healthy ecosystem. Here are five things you can do. Try to list five more.

1. Educate others in your family and community about the importance of protecting our natural enviroment 2. Build a fuel-efficient stove (so you use less wood when cooking) 3. Use more solar energy and less fossil fuels 4. Reduce, Reuse and Recycle 5. Determine what the problems are so you can take approprite action	**List five more**

Evaluation and Monitoring of the ecosystems around you

Reading

In order to overcome the problems harming an ecosystem, we need to know what those problems are. We need to **evaluate** how healthy an ecosystem is now and **monitor** how it changes over time.

Environmental monitoring means systematically measuring the quality of air, water, soil, and the health of living organisms over time.

To evaluate the health of the ecosystem, scientists and concerned citizens conduct quality tests to measure factors such as:

- Water - How clean is the water? What, if any, toxins are present? How much water is there? How fast is it flowing (for rivers)? What organisms are living in the water and how healthy are they? What is the average temperature? How acidic is it (for oceans)?
- Air – What toxins are present? What greenhouse gases are present and how much of each? What is the temperature?
- Soil – How much organic matter is in the soil? What living creatures live in the soil? Are any poisons present?
- Invasive species – Are there any invasive species? If so, how are they damaging the ecosystem?

When trying to determine the environmental health of a region or country people will look at the following:

1) Number and extent of protected areas.
2) Extent of wetlands
3) Status of fish stocks
4) Amount of wildlife
5) Waste disposal
6) Sewage treatment

Reflection

E **Discuss as a class.**
What are the social and economic costs/problems of unhealthy ecosystems?

Additional Activity

Map two ecosystems near you and evaluate how healthy there are. Use as many of the indicators you learned in this lesson as possible. Then write a proposal answering the following questions:

1) **What action should be taken to improve the health of your environment?**
2) **Who should be involved?**
3) **Outline an action plan or strategies to realize these actions.**

Lesson 10

Overview of Myanmar's Natural Environment

Myanmar: A Land of Rich Biodiversity

Reading

Myanmar is among the most biodiverse countries in southeast Asia. Almost all of Myanmar is located inside the Indo-Burma Biodiversity Hotspot, one of the world's 34 "richest and most threatened reservoirs of plant and animal life" as identified by Conservation International. Myanmar's terrain ranges from glaciers in the north to coral reefs in the south. It has four main physical areas: mountains in the north, highlands in the east and west, plains in the central area, and fertile delta regions in the south.
It is rich in natural resources and home to a wide variety of wildlife.

Here are some reasons why Myanmar is so biodiverse:

- It has a wide range of elevation - from 0 meters along the coast to 5,881 meters at the top of Hkakabo Razi, the tallest mountain in Myanmar. This wide range of elevation provides many different ecosystems and habitats.
- Myanmar has almost 2,000 km of coastline and 800 islands.
- About 45 % of Myanmar's land is forested, and there are a variety of different types of forests providing habit for many different kinds of plants and animals
- It has four major river systems

Some of the factors endangering Myanmar's biodiversity include:

Deforestation, habitat destruction, increased agriculture, mining, growth of rubber and palm oil plantations, population growth, pollution, overfishing, and wildlife trade

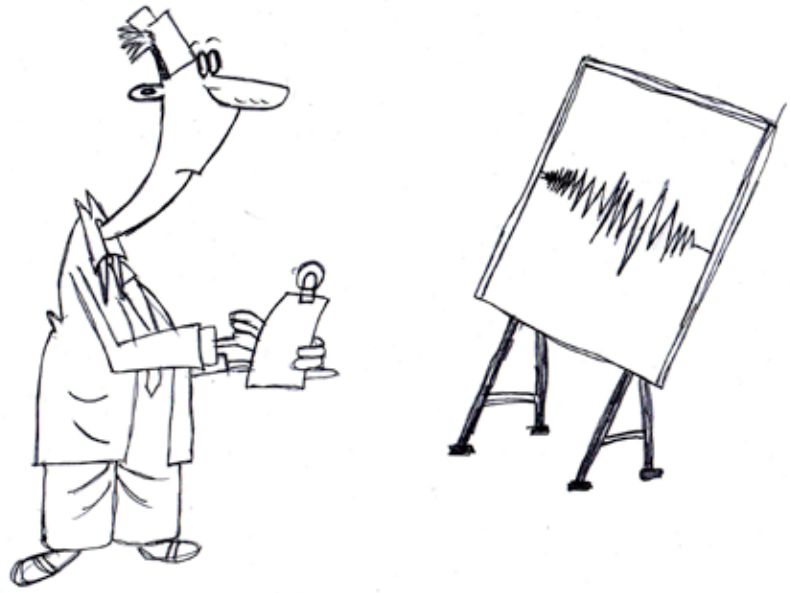
Discussion

1) **Why does Myanmar have so much biodiversity?**
2) **What are some of the reasons why Myanmar's biodiversity is threatened?**
3) **How should Myanmar's biodiversity be protected?**

Activity: survey

Survey the biodiversity of your environment by answering the questions below and prepare a simple presentation to share with your family and neighbors.

1) How biodiverse is you environment?
2) What are the main threats to biodiversity in your region?
3) How should biodiversity be protected in your environment?



Animal Species in Myanmar

Reading

The varied ecosystems of Myanmar provide habitats for many different kinds of animals and birds. There are 257 mammal species in Myanmar, ranging from flying lemurs to gibbons, and from bats to dolphins, and from elephants to the closely related dugong (a large, gentle vegetarian mammal that lives in the sea). Of these, 14 mammals are endangered, such as tigers, Red Pandas and the Javan Rhinoceros. Myanmar is home to almost 300 different species of reptiles including the Burmese python, the Indochinese spitting cobra, the Elongated tortoise and the Siamese crocodile. Twenty species of these reptiles are classified as endangered. More than 1,060 species of birds have been recorded in Myanmar, including the grey peacock-pheasant, the national bird of Myanmar. Of these, 51 birds are endangered.

Discussion

1) **What animals or trees have disappeared in your area?**
2) **Are there any endangered animals in your area?**
3) **What would happen if some species disappear from Myanmar? From the earth?**

Activity

Learn about and list the names of trees/plants and animal species found in your area. Complete the table and compare with a partner.

	Common	Rare
Tree/plant species		
Animal species		

Myanmar's Climate

Reading

Most of Myanmar has a tropical monsoon climate. It has high humidity, lots of sunlight, and high rainfall (during the rainy season). This type of climate is affected by the monsoons. The monsoons are the seasonal change in wind direction, which controls how much rain there is. Winds blow from the ocean to the land during the hot summer months, bringing rain. In the winter, the winds blow from the land to the oceans and there is little rain. There are three seasons in most of Myanmar: it is cool and dry from November to February, hot and dry during March and April, and hot, rainy and humid from May through October.

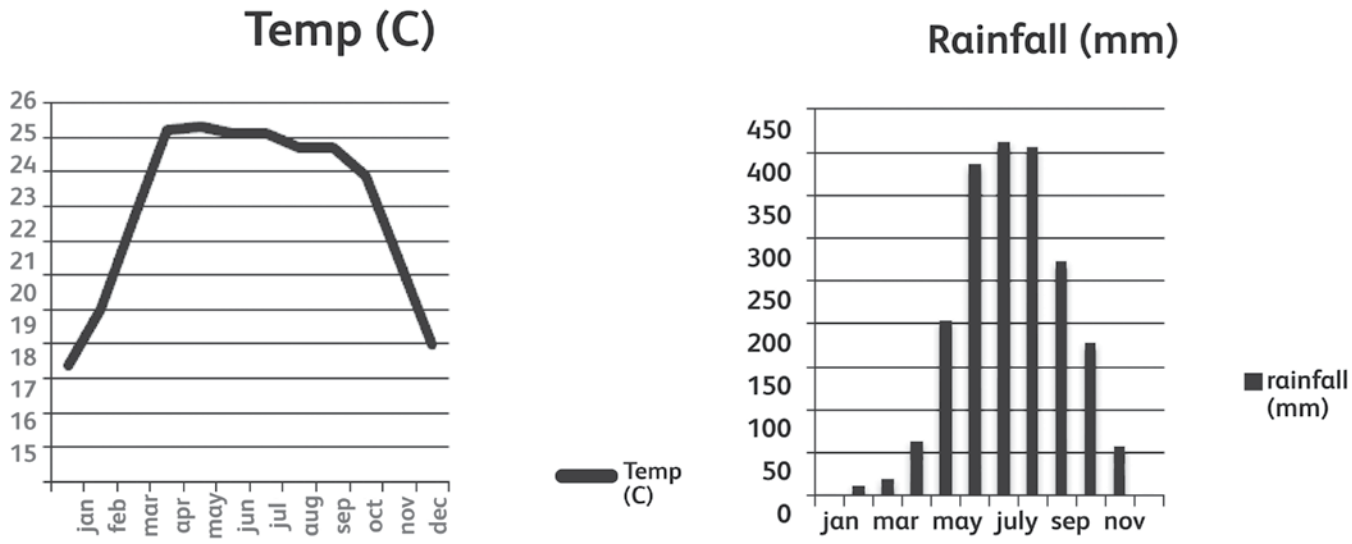
Myanmar's climate changes as the elevation climbs. Both temperatures and humidity (the total amount of water in the air) drop as the elevation gets higher. In the highlands of Shan State and Chin State temperatures can drop to near freezing in the winter. Above 4,000 meters, the climate is cold enough for snow.

The average annual rainfall in Myanmar ranges from 5,000 mm along the coast to 840 mm in Mandalay, which is in the Dry Zone. The annual temperature averages between 22 and 27 degrees C, though in the mountains the temperature drops below 0 C.

Because of global warming (the accumulation of greenhouse gases such as carbon dioxide in the atmosphere), Myanmar has become hotter over the past 75 years.

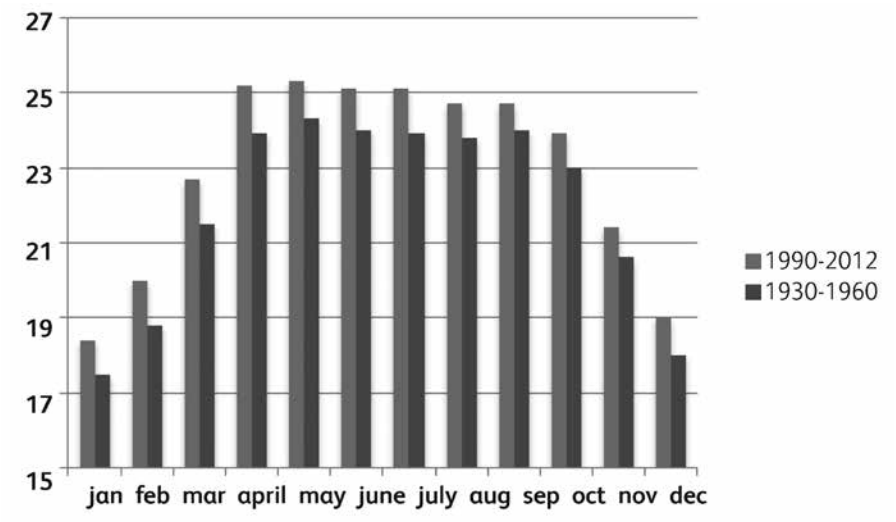
Activity

1) Look at the charts and complete the following table:



1	Hottest months	
2	Coolest month	
3	Wettest 3 months	
4	Driest 2 months	

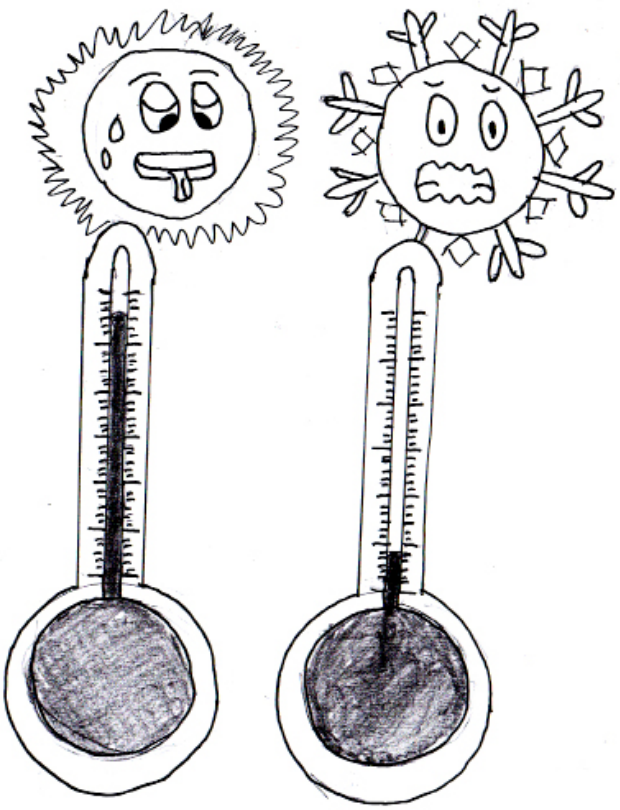
2) Look at the graph to complete the following table. The first cell has been completed for you.



	Jan	July	Oct	
1990-2012	18.5			**Temperature in degrees C**
1930-1960				

Discussion

1) Which part of Myanmar has the most rain?
2) Which season do you like the best? Why?
3) Have you, or your older neighbors or family members noticed that the temperatures are getting warmer over the past few years?
4) What do you think will happen if temperatures continue to rise?
5) What human activities do you think cause global warming?



The Marine Ecosystem

Reading

The marine environment is one of the largest and most important ecoregions in Myanmar. The coastline stretches 2,000 km from Bangladesh to Thailand. More than 800 islands belong to Myanmar including many in the Mergui **Archipelago,** off the coast of southern Myanmar. There are several bodies of water along Myanmar's coast, including the Bay of Bengal, the Andaman Sea and the Gulf of Martaban. All of these are part of the Indian Ocean.The marine environment is made up of different ecosystems. The following are important to Myanmar:

- **Coral Reefs**

Coral reefs and rain forests are the most biodiverse ecosystems in the world. Healthy coral reefs are essential to the health of the marine ecosystem since they provide habitat and food that support thousands of species of fish and other marine creatures. They are important economically for Myanmar since many Myanmar people depend on fishing for their food and income. Coral reefs also protect the coastline from big waves and erosion. Unfortunately, coral reefs all over the world are being killed for a variety of reasons including rising ocean temperatures and acidity.

- **Mangrove forests**

The mangrove ecosystem is also a very important part of the marine environment. Mangroves forests stabilize the shoreline, protecting it from erosion and from the effects of cyclones and seasonal flooding. Mangrove forests provide an important habitat for migratory birds and, like coral reefs, protect the young of many different types of sea organisms. Thus, these forests are also crucial for the fishing industry that is an important livelihood for many people living near the coast. Mangrove forests grow in river deltas and in muddy coastal areas. The trees can tolerate salt and are flooded by seawater during high tide. Of the total mangrove areas in Myanmar, 46 % is located in the Ayeyarwaddy Region, 37 % in the Tanintharyi Region and 17 % in Rakhine State. Unfortunately, mangrove forests are being cut down at a rapid rate to provide space for shrimp farms and other human activities.

- **Seagrass Beds**

Seagrasses are flowering plants that grow in shallow marine waters near the coast. Seagrass beds are also an important part of the marine ecosystem. They provide food and shelter for many sea creatures including crabs, fish and the endangered dugong. Seagrass beds also stabilize the sea floor and protect the coastline by reducing waves and the effects of currents. They also trap small particles floating in the seawater, which would otherwise harm coral reefs.

Discussion

1) **Where are most of the mangrove forests located in Myanmar?**
2) **Why are coral reefs an important ecosystem?**
3) **What benefits do seagrass beds provide?**

Activity

Research and draw a mind-map of all the consequences of damaging the marine ecosystem. You can use categories such as : environmental, economic, or social damages/ consequences.

Myanmar's Forests

Reading

Forests are one of Mynamar's most important natural resources. In comparison to neighboring countries, Myanmar still has large areas of natural forest. Currently about 45% of Myanmar is forested, which is down 70% since the time of independence in 1947. About 10% of Myanmar forest is primary forest, which are forests that have never been cut down and are the most biodiverse type of forests.

Forests are important for several reasons. First of all, if well managed, forests provide important resources for people in the form of valuable timber or wood for fuel. They also help protect the health of the natural environment in several ways. Forests provide oxygen as well as habitat for many species of birds and animals. They also help prevent erosion and flooding by holding the soil and absorbing water.

Forests adapt to the their environment. Different types of forests grow in different areas depending on how high the area is, how much rain falls, what the soil is like and how close to the sea it is. Because Myanmar has such a wide range of different climates, it has many different types of forests.

Here are the most common types of natural forests:

- Mixed deciduous forest, which covers 39% of forested areas, across all of central Myanmar. Deciduous trees are those that lose their trees seasonally.
- Hill and temperate evergreen forests cover 26% of forested areas. This type of forest is located at higher elevations in western, eastern and northern Myanmar. Evergreen trees are those that have leaves all year long.
- Tropical evergreen forest, which covers 16% of Myanmar's forested areas.
- Dry forest (10%) can survive with little water and grow mostly in the dry zone.
- Mangrove and swamp forests, which grow in the delta, along the eastern and southern coasts, and on Myanmar's many islands. Much of this type of forest has been cut to make room for agriculture.
- Pine forests grow in northwest Myanmar at elevations between 1,500 and 2,500 meters.

People have been planting forests to produce valuable timber in Myanmar since 1856, and managed forests are an important type of agriculture. Teak trees are the most common species planted. Other commercially planted species include pyinkado, padauk, pines, acacias and eucalypts.

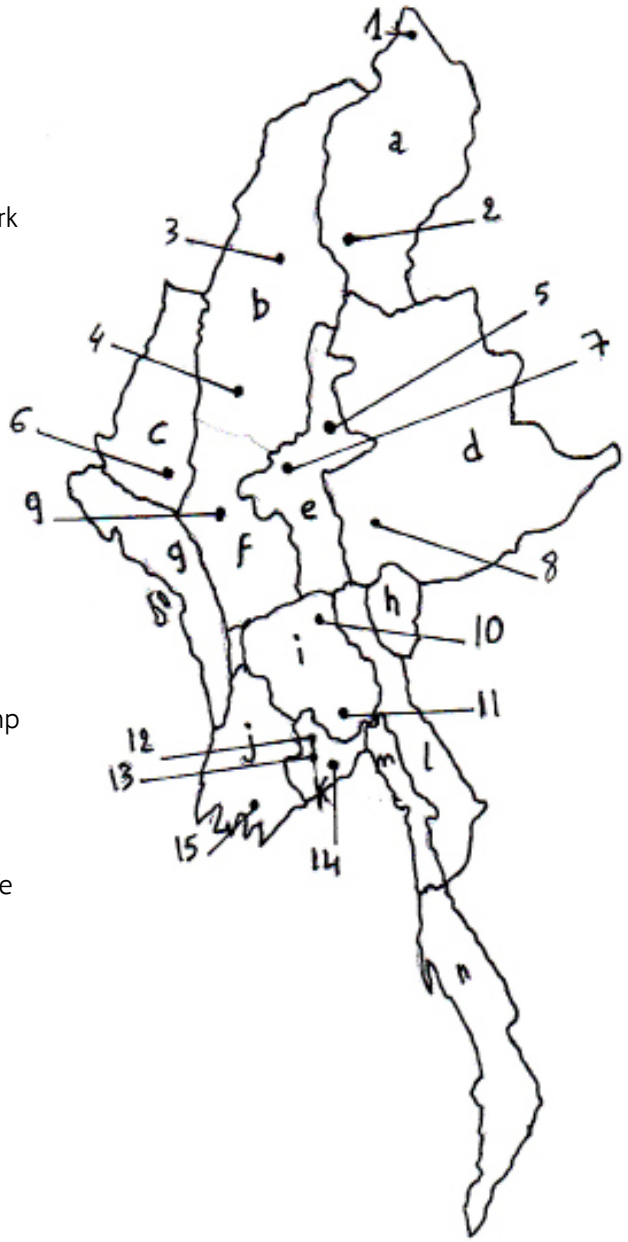
Fast Fact

Myanmar is home to:

- 2,088 tree species of which 1,347 species are big trees and 741 species are small trees
- 85 of these species provide premium quality timber
- 1,696 species of shrubs
- 96 species of bamboo

Source: www.fao.org

1. Khakaborazi national park
2. Indawgyi lake wildlife sanctuary
3. Chatthin wildlife sanctuary
4. Alaungdaw Kathapa national park
5. Maymyo botanical garden
6. Nat Ma Taung (Mt Victoria) national park
7. Popa mountain park
8. Inle lake wetland sanctuary
9. Shwesettaw wildlife sanctuary
10. Sein Ye forest camp
11. Moneyingyi wetland wildlife sanctuary
12. Myaing Hay Wun elephant camp
13. Hlawaga park
14. Yangon zoological garden
15. Meinmahla Kyun (island) wildlife sanctuary



States and divisions

a = Kachin state
b = Sagaing division
c = Chin state
d = Shan state
e = Mandalay division
f = Magwe division
g = Rakhine state
h = Kayah state
i = Bago division
j = Ayeyarwaddy division
k = Yangon division
l = Kayin state
m = Mon state
n = Thaninthayi division

Discussion

1) **What is the most common type of forest in Myanmar?**
2) **Which type of forests grow in the delta and along the coasts of Myanmar?**
3) **How do forests help protect the health of the natural environment?**
4) **How many different species of trees are there in Myanmar?**

Activity: survey

Survey the types of forest that grow in your township or state. Investigate how these forests are managed and how trees are used.

Dry Zone

Reading

A dry zone is an environment which has less than 40 inches (101.6 cm) of rain per year. Myanmar's dry zone is in the center of the country and includes the regions of Mandalay, Magway and Lower Sagaing. It is a flat area at a low elevation between the Shan Highlands to the east and the Rakhine, Yoma and Chin Hills to the west. It covers a little over 10% of the total area of Myanmar and is home to 1/3 to 1/4 of the population of Myanmar (figures vary depending on the source).

It is hot and dry - much of the dry zone is totally rainless for 7 months of the year. Because of poor soil, lack of water and other issues, most people who live there are very poor and struggle to support themselves. Myanmar's dry zone is one of the poorest areas of the country. Many people are food insecure, which means they do not have a dependable food supply.

Myanmar's dry zone is sometimes called the "oil pot" of Myanmar because a lot of edible oil crops such as sesame and groundnut, which can survive with little water, are grown in the area.

The Irrawaddy River, the most important Myanmar river, flows through the dry zone. Near its banks, where irrigation is possible, farmers are able to grow rice.

Australian Centre for International Agricultural Research (ACIAR) Report

Across the Central Dry Zone (CDZ), rainfall variability is high, water-use efficiency is low, vegetation cover is sparse and the soil is severely degraded – eroded and of low fertility. Smallholders farming in these environments face considerable challenges in achieving food security, while land managers lack the resources and capacity to support sustainable agricultural development. ...Salinity (salt) is a particularly serious issue in the CDZ due to saline sub - soils, high evapotranspiration rates and restricted outward drainage of groundwater.

Official blog from ACIAR on 16 April 2014

Discussion

1) **How much of Myanmar is designated as Dry Zone?**
2) **Why is the soil of the dry zone of such poor quality?**
3) **What do you think "water-use efficiency is low" means?**
4) **Why is Myanmar's Dry Zone called the "oil pot" of Myanmar?**
5) **What does "food insecure" mean? Do you know anyone who is food insecure? Explain.**

Activity

Refer to the ACIAR Report. Brainstorm and propose solutions and strategies to overcome the challenges faced in the dry zone.

Fresh Water

Reading

Fresh water ecosystems include wetlands, lakes, and rivers:

Wetlands

Wetlands are areas covered with shallow water at least part of the year. The water is shallow enough for water loving plants to grow. In Myanmar there are two types of wetlands, both of which are an important part of a healthy environment: coastal and inland. Coastal wetlands form a border between the sea and the land. Coastal wetlands in Myanmar are mostly mudflats, swamp forests and mangroves forests. They exist in the delta, along the coasts and on the edges of islands. Inland wetland ecosystems have fresh water and include rivers, lakes and fishponds, marshes, and seasonally flooded plains.

Wetlands are an important part of a healthy ecosystem because they:

- Provide food and protection for many kinds of fish and other aquatic animals
- Provide essential food and habitat for many bird species, especially for migratory birds. A series of wetlands along the flying routes of migratory birds is essential to their survival. Without wetlands to provide food and shelter, some birds will soon become extinct.
- Help prevent flooding and erosion
- Filter and clean water

Wetland ecosystems are also directly beneficial to humans because they:

- Stop sea water from getting into the agricultural areas
- Help prevent costal land from erosion and storms
- Provide medicinal plants
- Support the fishing industry by providing habitat for young fish
- Can boost ecotourism because many tourists enjoy bird watching

Some of the most important inland wetlands in Myanmar are located:

- In the Irrawaddy, Chindwin and Sittoung river basins
- Around the edges of Indawgyi Lake in northern Myanmar. During the winter, these wetlands provide food and habitat for almost 100 species of migratory birds, including some that come from as far away as Siberia.
- Around the edges Inle Lake
- In Moe Yun Gyi Wildlife Sancurary, near Bago, about an hour north of Yangon.

Rivers

There are four important rivers in Myanmar:

- The Irrawaddy (Ayeyarwady) is Myanmar's largest river and most important commercial waterway. It starts at the junction of the N'mai and Mali Rivers, in Kachin State and flows south for 2,170 kilometers (1,350 miles) to the Andaman Sea. The volume of the Irrawaddy changes during the year, becoming much higher in the summer because of the monsoon rains and melting glacier ice in northern Myanmar. It is a major transportation route for both passengers and goods. It is also a very important source of irrigation water required to grow rice and other crops. It is home to 43 fish species and the rare Irrawaddy dolphin. The Irrawaddy River brings fertile sediment and soil as it flows south through the delta and then into the Andaman Sea, which helps to make the delta very valuable agricultural land.
- The Chindwin River flows through difficult to access mountain ranges and forests so it has not been very damaged by humans.

- Sittaung River flows for 420 kilometers from the Shan Plateau southeast of Mandalay to the Gulf of Martaban. At its mouth it is strongly affected by the ocean tides, which makes it difficult for boats to navigate. It is used mostly to float timber. Less soil washes down than the Irrawaddy so its delta is not as fertile.
- Salween (Thanlwin) River begins in China and flows 1,325 km south across the Shan Plateau in eastern Myanmar.

Lakes

- Indawgyi Lake located in Kachin State in northern Myanmar covers an area of 116 square kilometers (45 square miles) and is Myanmar's largest lake. It was probably created by an earthquake many years ago. It is still very pristine, meaning that it has not yet been damaged very much by humans. It is an important feeding ground for migrating birds.
- Inle Lake, a shallow lake located on the Shan Plateau covers 67 square kilometers (26 square miles) and is Myanmar's second largest lake. It is the remains of an inland sea that is still shrinking. It is being damaged by the facilities built for the huge numbers of tourists who visit the area each year. In June, 2015, Inle Lake was designated as the first UNESCO Biosphere Reserve in Myanmar. It provides habitat for turtles, fish, otters, and many birds, including the endangered Sarus crane.

Discussion

ated?

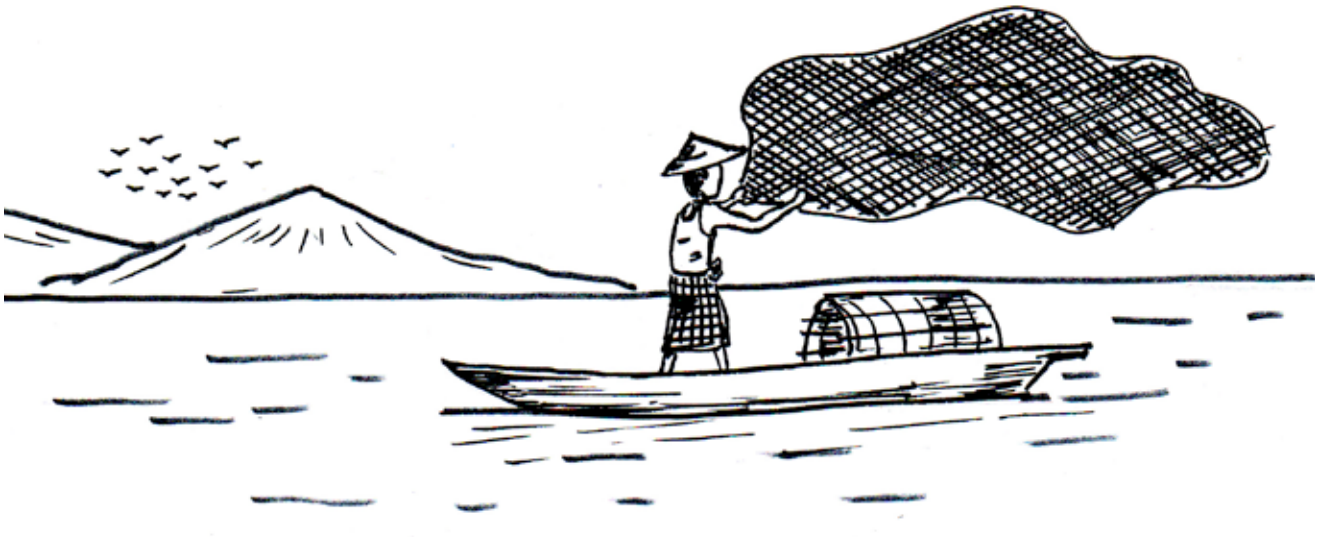
2) What is the volume of the Irrawaddy River?

3) Complete the table below.

Wetlands are beneficial to the natural environment because:	Wetlands are beneficial for humans because:

Activity: research

Research online or in your local library to better understand the economic and social benefits of wetlands, lakes and rivers in Myanmar.



Human Environments

Reading

The human or built environment has a huge impact on Myanmar's natural environment. In addition to urbanization (towns and cities), three human activities that have a huge impact on the natural environment include agriculture, mining, and hydroelectric dams.

Agriculture

Agriculture is essential to human life as it provides the food people need to live. Agriculture is also a major source of income for Myanmar, both on the national and individual level. Agriculture is the main source of national income. It provides 60% of Myanmar's Gross National Product (the total value of goods and services produced by a country in one year) and employs 65% of Myanmar's labor force. Rice is the primary crop. Other important crops include beans, sesame, groundnuts, sugar cane, timber as well as fish. In recent years, extensive rubber and palm oil plantations have been planted and these are likely to expand. The biggest environmental impact of agriculture is that so many forests are cut down, wetlands are drained and other natural habitats are destroyed to make room for crops. In Rakhine state for example, many hectares of mangrove forests have been cut to establish shrimp farms. Other problems include the use of harmful pesticides, herbicides and fertilizers. A third problem is that so much water is being used to irrigate crops that some water sources are beginning to run dry.

Dams

There are almost 200 large dams in Myanmar that have been built to produce electricity. Hydroelectricity has many advantages. Unlike fossil fuels, it is an environmentally friendly, clean source of energy because it doesn't pollute the air and it produces no greenhouse gases. It is also renewable because water itself is not reduced or used up in the process of creating it.
However, dams harm the natural environmental and negatively affect people living nearby. Dams prevent fish and other aquatic life from moving freely and stop the movement of nutrient rich sediment from flowing downstream. Dams also flood large areas of land forcing many people to move. Dams can break during natural disasters such as earthquakes. One of the reasons the Myitsone dam is so controversial is because it is located near the Sagaing fault line. If an earthquake destroyed the Myitsone Dam, the lives of hundreds of thousands of people living there it would be endangered.

Mines

Myanmar is enriched with valuable minerals such as copper and jade. As these minerals are buried deep in the earth, large mines are built to bring these precious minerals up to the surface. The minerals bring important income, but there is a large environmental and social cost. Chemicals used in the mining process contaminate the soil and groundwater nearby. This often harms people and animals in the area. People are often forced to relocate from areas where mines are dug. The most controversial mine in Myanmar is probably the Letpadaung copper mine project in the Sagaing region of northern Myanmar.

Discussion

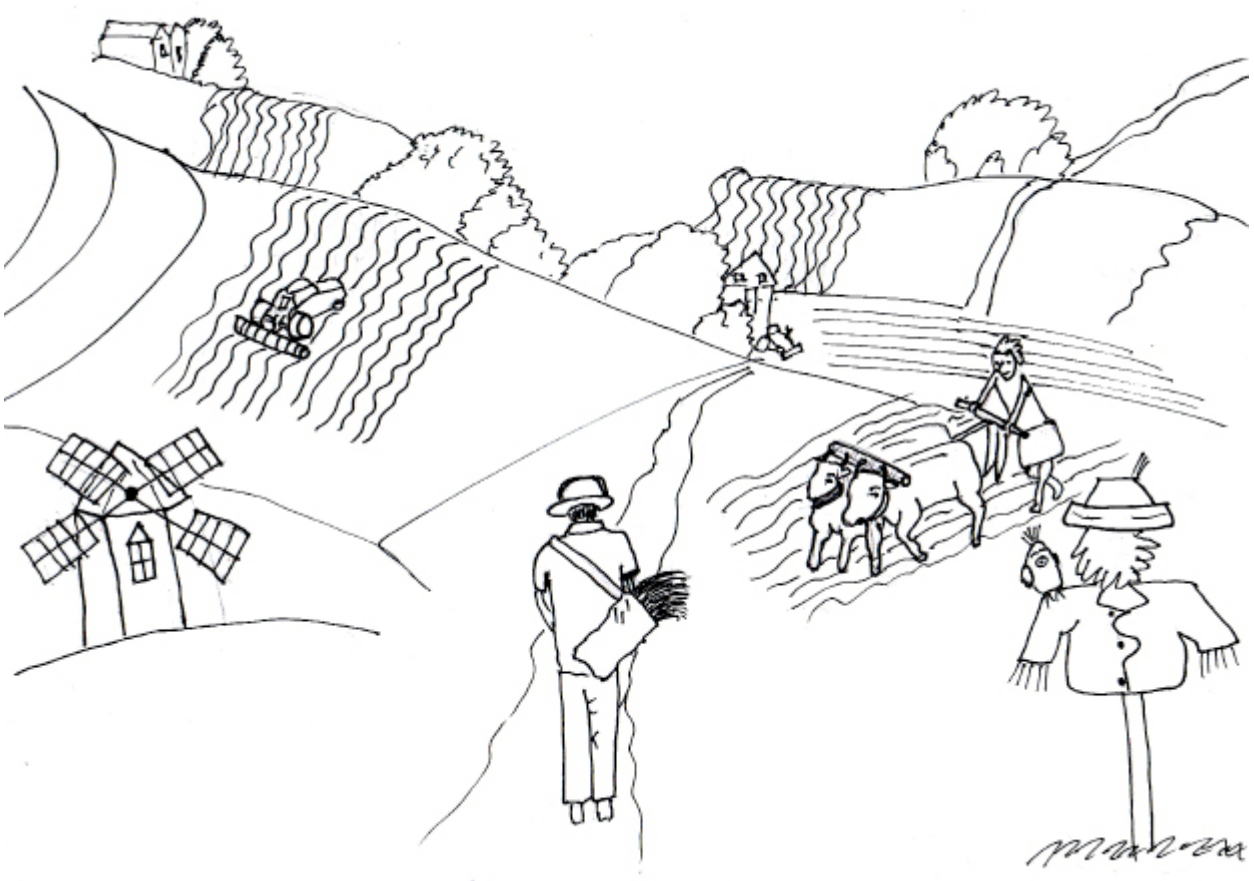
1) **What are the advantages of hydroelectricity?**
2) **What do you think? Should the Myitsone Dam be built or not? Is the energy it could produce worth the damage it causes?**
3) **Why is agriculture so important?**

Activity: research

Pick one of the following topics, conduct research on it and share your findings in a presentation.

1) **The product chain of a mineral (jade, gold, etc).** What is the extraction site location and conditions? What is the production process? What is the commercialization process? What are the exportation destinations? What is the price variation; between price at production and exportation prices? What are the environment and social costs?

2) **The agricultural activities in your community or nearby where you live.** What crops are cultivated? What farming methods are used? Is it organic farming or chemical farming? Are there any environmental problems due to agriculture? Are their large-scale rubber or palm oil plantations? Are the crops mostly sold locally, or transported to distant locations? Is their fish farming in your location? Is their slash and burn agriculture? Has farmland been damaged by flooding? Do many people grow food for their own consumption?



Projects Package

The projects below are designed to help you improve your knowledge as well as practice the skills you have acquired in this course.

A) Research project: Topic of choice
B) Survey: Environmentally friendly practices in your context
C) Survey: How healthy is your environment?
D) Interviews: Public opinion on a topic of choice
E) Observation: Study your local environment
F) Personal action

A) Research project: Topic of choice

The research project aims to expand your knowledge on specific topics. This project can be done individually or in small groups (2-3 students).

To finish this project, follow the steps below:

1) Select an environmental topic of your interest (examples below)
2) Formulate a question of research
3) Conduct the research: collecting and analyzing information
4) Prepare a written paper (2-4 pages), answering a question on the topic
5) Give an oral presentation (5-10 minutes), allowing time for questions and answers.

Tips: Resources to find information include: internet, books available in your school or town library and materials contained this course. You may also interview experts in the subject you are researching.

Topics could include:

1) Myanmar forests
2) Timber production in Myanmar
3) Managed forests
4) The islands of Myanmar
5) The rivers of Myanmar
6) The mountains of Myanmar
7) Waste disposal
8) Solar energy
9) Wind energy
10) Hydroelectric energy
11) A particular animal
12) Organic agriculture

B) Survey: Environmentally friendly practies in your context

The survey project will help you to learn more about local practices in your community. This project can be done individually or in small groups (2-3 students sharing the same community).

This survey is a list of questions designed to gather information from a group of people. Respondents may fill out the survey themselves, or the researcher can ask the questions orally and record the answers. Respondents may include farmers, villagers, government officers, young people, and environmental activists.
Questionnaires should be simple and easy to fill out; each question should ask only one thing and the data should be easily quantifiable.
For the survey, you can use the example questionnaires below or make your own according to your topic of choice. You can use more than one questionnaire for the same topic.

Topics could include:

1) Environmentally friendly farming practices
2) Plastic bag use
3) Natural resources use and management
4) Water cycle and use in the household
5) Transportation means
6) Toilet systems

Survey #1: Environmentally friendly farming practices

Farmer: _____

	Questions	Answers	
1	Do you use organic farming methods	Yes	No
2	Do you know what compost is?	Yes	No
3	Do you use compost to fertilize your fields?	Yes	No
4	Do you use chemical fertilizers?	Yes	No
5	If so, what kind do you use?		
6	Do you use manure as fertilizer?	Yes	No
7	Do you use chemical pesticides?	Yes	No
8	Do you rotate crops?	Yes	No
9	What do you do with your organic waste? Check all that apply.	_____ Feed it to animals _____ Burn it _____ Compost it _____ Just leave it on the ground Other:	

Survey #2: Plastic bag use:

Plastic bags are very damaging and this is a relatively easy form of pollution to give up. Choose a location and determine how many plastic bags are used and what happens to plastic bags. Example locations are: markets, villages, and in the household.

Location: _____

	Questions	Answers
1	What do you sell or buy?	_____ Vegetables and Fruit _____ Packaged goods _____ Other
2	How many plastic bags do you use per week?	_____ 0 – 24 _____ 25 – 49 _____ 50 – 100 _____ 100 – 200 _____ More than 200
3	How much money do you spend on plastic bags per week?	
4	How many people refuse plastic bags and bring their own re-usable plastic bags or a basket? or How often do you refuse plastic bags and bring your own re-usable plastic bags or a basket?	Out of every 100 customers/time per month: _____ 0 - 4 people/times per month _____ 5 – 10 _____ 11 – 20 _____ 21 – 30 _____ 31 – 50 _____ More than 50
5	Do you automatically give people a plastic bag or do you ask them first?	_____ Ask _____ Automatically give
6	How do you use the old plastic bags?	
7	Where do you put the destroyed plastic bag?	

C) Survey: How healthy is your environment?

The survey project will help you to better understand the health of your environment. This project can be done individually or in small groups (2-3 students sharing the same environment).

To maximize learning from this project, follow the steps below:

1) Complete questionnaire # 1: What is your local natural environment like?
2) Complete questionnaire # 2: How healthy is your natural environment?
3) Discuss your summarized findings with your class
4) Take actions to improve the health of your environment

Questionnaire # 1: What is your local natural environment like?

Before deciding where to go, you need to know where you are. Here are some questions to get you thinking about the natural environment in your area:

1) What is the temperature outside? Is this temperature normal for this time of year, or is it hotter or colder than usual?
2) When did it last rain? Does it rain a lot in your area? Do you know how much rain your area gets in an average year? Is there a rainy season, or does it rain throughout the year? Is flooding a problem in your area?
3) If you walk from your school for 10 minutes how many different kinds of trees will you see?
4) Have you ever seen a wild animal in your area?
5) Is there a body of water nearby, such as a river, lake or the sea?
6) Is there a forest you can walk to?
7) Are there many crops grown in your area? If so, what kind?
8) What sort of fuel do most people use to cook?
9) What happens to the sewage in your community?
10) Where do you get your drinking water from?
11) Do most people in your community use toilets? Are they flush toilets or pit toilets?
12) What happens to the waste in your community? Is there a pick up service, do you burn it? Bury it?
13) Do you grow any of your own food?
14) Where does most of the food you eat come from? Is it grown in the local area? Does it come from somewhere else in Myanmar or from a different country?
15) Do you have running water in your home? If not, how far away is your water source?

Questionnaire #2: How healthy is your natural environment?

Determining factors harming your local ecosystems will help you to decide what type of project you would like to do. Here are some questions to get you thinking.

	Questions	Answers
1	Overall, how healthy is your local environment/ ecosystem?	1 2 3 4 5 6 7 8 9 10 Very sick Very healthy
2	How informed and aware are people in your local community about the importance of environmental health?	1 2 3 4 5 6 7 8 9 10 Not at all Very aware
3	How much do people in your community care about the health of the natural environment?	1 2 3 4 5 6 7 8 9 10 Not at all They care a lot
4	How much non-biodegradable litter (trash made out of plastic, metal and other materials that do not rot) do you see as you walk around your neighborhood?	1 2 3 4 5 6 7 8 9 10 A lot Not much
5	How much non-biodegradable trash do you see in local water sources?	1 2 3 4 5 6 7 8 9 10 A lot Not much
6	What happens to most of the garbage in your community?	1. It is burned 2. It is buried 3. It is just dumped in a stream bed or by the side of the road 4. The government municipality collects it and takes it away 5. Other _____
7	Where do you get your drinking water?	1. From a tap inside my house 2. I buy it 3. From a tap or well outside the house but less than a 5 minute walk away 4. From a well more than a 5 minute walk away 5. From a river or lake 6. Other _____
8	Where do you get your washing water?	1. From a tap inside my house 2. I buy it 3. From a tap or well outside the house but less than a 5 minute walk away 4. From a well more than a 5 minute walk away 5. From a river or lake 6. Other _____
9	What do you or your family use for cooking fuel?	1. Electric stove 2. Gas/kerosene stove 3. Charcoal 4. Wood we buy 5. Other _____

10	What do most people use for power?	1. Electricity provided by the government 2. Solar power from solar panels on/around our homes 3. Kerosene 4. Other _____
11	Where does the raw sewage go?	1. To a town septic system 2. To a septic tank buried under the ground 3. Into an unsealed pit dug into the earth 4. It just drops onto the ground 5. Directly into a river or lake 6. Other _____
12	Do you know of any farmers who compost and use compost as fertilizer?	
13	Where do farmers get chemical fertilizer from? Are the directions in a language local people can read?	
14	List all the wild animals you or any of your group members have ever seen in the local area.	
15	List any wild animals that used to live in the area that no longer do so (i.e. Animals that older members of your community may have seen long ago).	
16	If you live near the sea or a river or a lake – has the fish population changed much in recent years? How so?	
17	Are there any invasive species that you are aware of? (plants, animals or insects)	
18	Do you live near a large dam?	
19	Are their mines in the area?	
20	Are there large factories or power plants in the area?	
21	What are the biggest environmental problems in your community?	
22	To your knowledge has there ever been any environmental tests or surveys done to measure the environmental health in your local community?	
23	Are there any people or organizations currently working to protect the natural environment?	
24	Are there any national parks or protected areas nearby?	
25	Has your local environment been damaged by floods in recent years?	

D) Interview: Public opinion on a topic of choice

Conducting in-depth interviews is similar to conducting surveys and questionnaires but enables you to get more detailed information. You can ask open-ended questions and ask for more information which is not really possible when using questionnaires or surveys. Respondents may include farmers, villagers, government officers, young people, and environmental activists.

Here are some questions you could ask:

1) What are the most serious environmental problems in your area? Why?
2) If you could solve one environmental problem, what would it be? How?
3) Would you be willing to pay more money for organic food? Why or why not?
4) Would you be willing to teach others about environmental problems and what can be done to overcome them?
5) What is global warming? What impact does it have?
6) What is climate change? What impact does it have?
7) Should land be protected with laws? Why and how?
8) Is the government doing enough to protect the environment? Why or why not?

E) Observe: Study your local environment

This project will help you learn about a local environment by actively observing human actions and seasonal change and their impacts.

To maximize learning from this project, follow the steps below:

1) Choose a topic or question
2) Develop your observation plan (elements, location, period, etc.)
3) Compare your findings with a different location and period.
4) Compare your findings with a partner and in class

You can pick a question/topic from other projects or take one of the following ideas:

1) Sit in a teashop near a market and watch the shoppers to see how many take plastic bags from shopkeepers and how many bring a basket or re-usable plastic bag.
2) Observe how many people throw trash on the ground rather than put it in a trash bin.
3) Walk around your neighborhood and observe. Is there a lot of trash? What is most of it – plastic bags, food wrappers, plastic bottles, glass bottles, cans?
4) Walk around your neighborhood and observe. Are there any recyclers? What do they pick up? Where do they take it?
5) Collect a leaf from as many different kinds of trees/plants as you can. What kinds of trees are they? Are they edible?

F) Personal Action

This project will help foster an attitude of protecting the environment on a daily basis. Learners are invited to join two challenges: A Personal Practice Challenge and a Community Action Challenge.
It is useful to keep track of your environmentally friendly actions. You can also keep track of the frequency and quality of your actions.

Personal Practice Challenge

I will:

- Use reusable bags instead of plastic bags
- Compost organic waste instead of burning it
- Use less water
- Eat less meat, especially beef
- Recycle plastic, glass and aluminum

Community Action Challenge

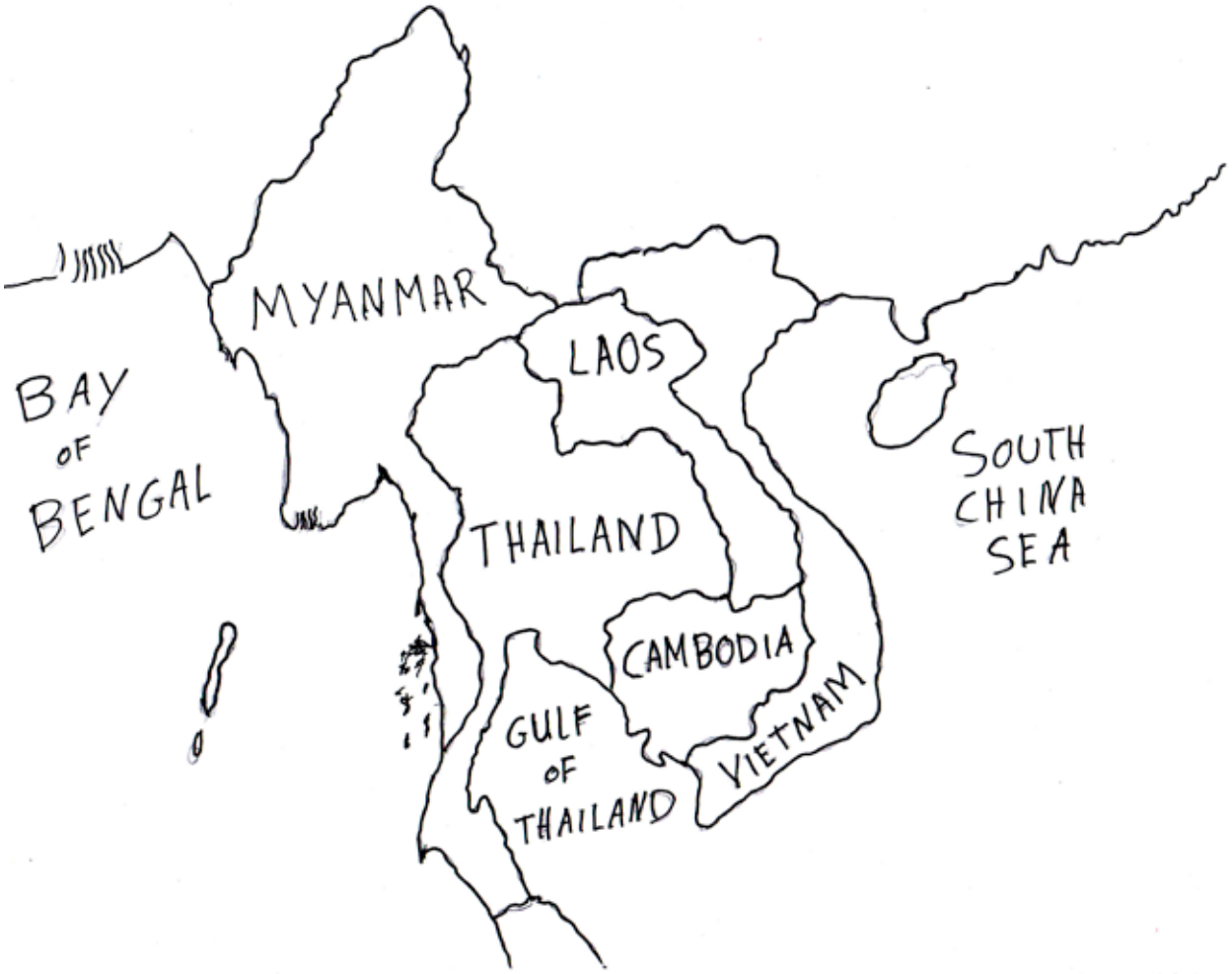
I will:

- Clean the trash in my neighborhood
- Use filtered water instead of water from small plastic bottles
- Build a pit latrine
- Purchase or make a more fuel efficient cooking stove
- Educate people in my community
- Plant trees

Use this page for your notes.

Extras

Extra #1: Globally Threatened Species in the Indo-Burma Hotspot



Part A

Species	Global Threat Status				Distribution by Country					
	Critically Endangered	Endangered	Vulnerable	**Total**	Cambodia	China	Lao PDR	Myanmar	Thailand	Vietnam
Mammals	12		39		31		40		47	
Birds		19		**85**		37		41		42
Reptiles	13		14		14		16		19	
Amphibians		16		**48**		33		0		15
Fishes	25		58		31		44		58	
Invertebrates		21		**66**		10		4		25
Plants	69		151		33		25		98	
Total		**230**		**754**		**305**		**172**		**335**

Part B

Species	Global Threat Status				Distribution by Country					
	Critically Endangered	Endangered	Vulnerable	**Total**	Cambodia	China	Lao PDR	Myanmar	Thailand	Vietnam
Mammals		37		**88**		35		43		46
Birds	12		54		28		24		46	
Reptiles		20		**47**		20		23		25
Amphibians	0		32		4		5		4	
Fishes		28		**111**		17		16		34
Invertebrates	9		36		0		6		28	
Plants		89		**309**		153		45		148
Total	**140**		**384**		**141**		**160**		**300**	

Periodic Table of the Elements

1 IA 11A	2 IIA 2A	3 IIIB 3B	4 IVB 4B	5 VB 5B	6 VIB 6B	7 VIIB 7B	8	9 VIII 8	10	11 IB 1B	12 IIB 2B	13 IIIA 3A	14 IVA 4A	15 VA 5A	16 VIA 6A	17 VIIA 7A	18 VIIIA 8A
1 H Hydrogen 1.008																	2 He Helium 4.003
3 Li Lithium 6.941	4 Be Beryllium 9.012											5 B Boron 10.811	6 C Carbon 12.011	7 N Nitrogen 14.007	8 O Oxygen 15.999	9 F Fluorine 18.998	10 Ne Neon 20.180
11 Na Sodium 22.990	12 Mg Magnesium 24.305											13 Al Aluminum 26.982	14 Si Silicon 28.086	15 P Phosphorus 30.974	16 S Sulfur 32.066	17 Cl Chlorine 35.453	18 Ar Argon 39.948
19 K Potassium 39.098	20 Ca Calcium 40.078	21 Sc Scandium 44.956	22 Ti Titanium 47.88	23 V Vanadium 50.942	24 Cr Chromium 51.996	25 Mn Manganese 54.938	26 Fe Iron 55.933	27 Co Cobalt 58.933	28 Ni Nickel 58.693	29 Cu Copper 63.546	30 Zn Zinc 65.39	31 Ga Gallium 69.732	32 Ge Germanium 72.61	33 As Arsenic 74.922	34 Se Selenium 78.09	35 Br Bromine 79.904	36 Kr Krypton 84.80
37 Rb Rubidium 84.468	38 Sr Strontium 87.62	39 Y Yttrium 88.906	40 Zr Zirconium 91.224	41 Nb Niobium 92.906	42 Mo Molybdenum 95.94	43 Tc Technetium 98.907	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.906	46 Pd Palladium 106.42	47 Ag Silver 107.868	48 Cd Cadmium 112.411	49 In Indium 114.818	50 Sn Tin 118.71	51 Sb Antimony 121.760	52 Te Tellurium 127.6	53 I Iodine 126.904	54 Xe Xenon 131.29
55 Cs Cesium 132.905	56 Ba Barium 137.327	57-71	72 Hf Hafnium 178.49	73 Ta Tantalum 180.948	74 W Tungsten 183.85	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.22	78 Pt Platinum 195.08	79 Au Gold 196.967	80 Hg Mercury 200.59	81 Tl Thallium 204.383	82 Pb Lead 207.2	83 Bi Bismuth 208.980	84 Po Polonium [208.982]	85 At Astatine 209.987	86 Rn Radon 222.018
87 Fr Francium 223.020	88 Ra Radium 226.025	89-103	104 Rf Rutherfordium [261]	105 Db Dubnium [262]	106 Sg Seaborgium [266]	107 Bh Bohrium [264]	108 Hs Hassium [269]	109 Mt Meitnerium [268]	110 Ds Darmstadtium [269]	111 Rg Roentgenium [272]	112 Cn Copernicium [277]	113 Uut Ununtrium unknown	114 Fl Flerovium [289]	115 Uup Ununpentium unknown	116 Lv Livermorium [298]	117 Uus Ununseptium unknown	118 Uuo Ununoctium unknown

Lanthanide Series	57 La Lanthanum 138.906	58 Ce Cerium 140.115	59 Pr Praseodymium 140.908	60 Nd Neodymium 144.24	61 Pm Promethium 144.913	62 Sm Samarium 150.36	63 Eu Europium 151.966	64 Gd Gadolinium 157.25	65 Tb Terbium 158.925	66 Dy Dysprosium 162.50	67 Ho Holmium 164.930	68 Er Erbium 167.26	69 Tm Thulium 168.934	70 Yb Ytterbium 173.04	71 Lu Lutetium 174.967
Actinide Series	89 Ac Actinium 227.028	90 Th Thorium 232.038	91 Pa Protactinium 231.036	92 U Uranium 238.029	93 Np Neptunium 237.048	94 Pu Plutonium 244.064	95 Am Americium 243.061	96 Cm Curium 247.070	97 Bk Berkelium 247.070	98 Cf Californium 251.080	99 Es Einsteinium [254]	100 Fm Fermium 257.095	101 Md Mendelevium 258.1	102 No Nobelium 259.101	103 Lr Lawrencium [262]

Alkali Metal | Alkaline Earth | Transition Metal | Semimetal | Nonmetal | Basic Metal | Halogen | Noble Gas | Lanthanide | Actinide

Use this page for your notes.

Glossary

A

Aquatic (adj): Of a plant or animal that lives in water
Atmosphere (n): The thick blanket of gases surrounding the earth and other planets
Atom (n): The smallest part of matter

B

Bacteria (n): Very simple single-celled organisms; the smallest of all living creatures
Biodiversity (n): The variety of life forms (including plants, animals, insects, birds, bacteria) living on our planet
Biodiversity hotspot: An area that 1) is home to many different kinds of species and 2) is in danger of being destroyed
Biome (n): A group of similar ecosystems in the same area. A biome has similar weather, rainfall, plants and animals. Examples of biomes include the desert, rainforest, grassland, and tundra.

C

Carbon (n): A chemical element that is found in all living organisms; it's abbreviation is C
Carbon cycle: Several natural processes that continuously move carbon atoms through the oceans, atmosphere, plants and other living organisms
Carbon dioxide: CO2 - A colorless, odorless gas made out of carbon and oxygen. It is produced by burning fossil fuels such as coal and petroleum and is a greenhouse gas.
Carnivore (n): An animal that eats only meat from other animals
Classification/ taxonomy (n): The process by which scientists group living organisms based on how similar they are
Climate (n): The weather conditions including temperature and rainfall in an area over a long period of time
Climate change: The global climate changes such as rising temperature and increased or decreased rainfall caused by global warming
Combustion (n): The process of burning something
Compost (v): Decayed organic material used as a fertilizer
Compound (n): A substance made out of different elements combined together
Condense (v): To change from gas to liquid
Conserve (v): Protecting something from damage, especially something of environmental or cultural value

D

Deforestation (n): Cutting down forests to provide land for human use such as agriculture, cattle grazing, and building houses or other buildings

E

Ecosystem (n): A community of all the living organisms in an area interacting with each other and with the physical environment
Element (n): Matter that is made out of only one kind of substance
Elevation (n): The height of a place above sea level
Endangered (adj): Of a species of plants, animals, or insects in danger of becoming extinct, meaning that there will be no member of that species left alive
Endemic (adj): When a plant, animal or insect naturally occurs in an area
Energy (n): The capacity of strength needed to sustain an activity
Erosion (n): The gradual destruction of soil/land by wind or water
Evaporate (v): To change from liquid to gas
Extinct (adj): When an animal, insect, bird, plant or other organism no longer exists

F

Fertile (adj): (Of land/soil) having a lot of nutrients and thus being capable of growing strong healthy crops
Food insecure: People who do not have a dependable food supply
Fossil fuels: Fuels such as coal, oil, petroleum, or natural gas that are made out of the remains of plants which died millions of years ago

G

Global warming: Hotter temperatures in the atmosphere and ocean caused by greenhouse gases such as carbon dioxide
Greenhouse gas: Gases in the earth's atmosphere which trap the heat of the sun and make the earth warmer, leading to global warming. Greenhouse gases include carbon dioxide, methane, nitrous oxide and water vapor.

H

Habitat (n): The natural home or environment of an animal, plant, insect, or bird
Herbivore (n): An animal that eats only plants
Human environment: Areas built by humans such as cities, towns, factories, mines, and farms
Humidity (n): The amount of water vapor in the air

I

Invasive species: A living organism that moves into a new ecosystem from somewhere else and causes a lot of harm to other living organisms in that ecosystem

J-
K-

L

Landfills (n): A place where trash is buried in a deep hole
Latitude (n): How far a place is north or south of the equator

M

Mass (n): The amount of matter in an object
Matter (n): Anything that takes up space and has mass
Molecule (n): A group of two or more atoms combined together
Monsoon (n): The seasonal change in wind direction in South and Southeast Asia. Wind blows from the southwest between May and September, bringing lots of rain, and from the northeast between October and April (the dry season)

N

Native species: A living organism that originally comes from the ecosystem where it lives
Natural environment: All the living and nonliving things that occur naturally on earth
Natural resource: Materials and substances that 1) exist naturally in nature and 2) are beneficial to humans. Examples include water, trees, oil, and gold.
Nitrogen cycle: The continuous circulation of nitrogen through the atmosphere, soil, plants, and animals (that eat the plants) and then back to the atmosphere
Nutrients (n): A substance that provides the nourishment a living organism needs to live

O

Omnivore (n): An animal that eats both plants and animals
Organic (adj): Something that comes from living matter. Organic farming is farming without chemical fertilizers or pesticides.
Oxygen cycle: The process which continuously moves oxygen through the atmosphere, plants, animals, and the earth's crust
Ozone layer: A layer in the upper atmosphere that prevents dangerous radiation from the Sun from reaching the surface of the Earth

P

Periodic table: A table which organizes all the known chemical elements according to the atomic number of each element
Photosynthesis (n): The process by which green plants convert sunlight, carbon dioxide and water into food
Pollution (n): The process of harmful or poisonous substances affecting the environment
Predator (n): A creature that hunts and eats other creatures
Preserve (v): The act of maintain something (e.g. a forest or other wild area) at its original or existing state
Prey (n): A creature that is eaten by other creatures (by predators)

R

Renewable energy: Energy from a source that does not run out such as wind or solar energy

S

Species (n): A group of living organisms similar to one another. Members of the same species can produce offspring (i.e. children) together.
Sustainable (adj): Maintaining something at its current level; of something that can exist on its own without requiring outside support

T-
U-
V -

W
Water cycle: The movement of water between the earth's oceans, fresh water, atmosphere and land

X-
Y-
Z-

Translations

Aquatic (adj) a&aeowG/
Atmosphere (n) avx/
Atom (n) tuwr/

Bacteria (n) buw;&;,m;/
Biodiversity (n) ZOrS;ursm;/
Biodiversity hotspot ZOrS;ursm;&onae&m/
Biome(n) obmOvijyi/

Carbon (n) umAe/
Carbon cycle umAeoo&m/
Carbon dioxide umAe'iatmuq'/
Carnivore (n) tom;pm;owG/
Classification/ taxonomy (n) ou&rS;rsm;cjcr;pwjzmjci;/
Climate (n) &moOw/
Climate change &moOwajymi;vr/
Combustion (n) avmiuir;jci;/
Compost (n) obmOajrlozm/
Compound (n) aygi;pyjci;/
Condense (v) ai&najymi;on/
Conserve (v) xe;or;on/

Deforestation (n) opawmjyle;w;jci;/

Ecosystem (n) a*[pep/
Element (n) j'ypi/
Elevation (n) jrirm;onwnae&m/
Endangered (adj) aysmuu,rntE&m,&aom/
Endemic (adj) tpvu/
Energy (n) pr;ti/
Erosion (n) ajrwupm;r/
Evaporate (v) tailysonr/
Extinct (adj) rS;oe;aysmuu,aom/

Fertile (adj) ajraumi;ajrqvmjzpapaom/
Food insecure tpm;taomurzvr/
Fossil fuels avmipm/

Global warming urmuu;yaE;vmr/
Greenhouse gas revtr"mwai/

Habitat (n) usupm;&mae&m/
Herbivore (n) tyipm;ow0g/
Human environment vom;w\yw0e;usi/
Humidity (n) ppwr/
Invasive species a&ajymi;aexionou&rs;pw/
Landfills (n) truwi;/
Latitude (n) vuus/

Mass (n) xxn/
Matter (n) &y0w/
Molecule (n) armvus;v/
Monsoon (n) rwoe/

Native species ue0;aexionrs;pwrsm;/
Natural environment obm0yw0e;usi/
Natural resource obm0t&i;tjrp/
Nitrogen cycle Eux&*sioo&m/
Nutrients (n) tm[m&/

Omnivore (n) tppm;ow0g/
Organic (adj) atm*ep/
Oxygen cycle atmuq*sioo&m
Ozone layer tZe;vm/
Periodic table "mwai*Powjyz,m;/
Photosynthesis (n) tyiwtpmcsujci;/
Pollution (n) npnr;r/
Predator (n) tom;pm;ow0g
Preserve (v) umu,xe;or;on/
Prey (n) om;aumi/

Renewable energy tzewvvto;jyEionpr;ti/
Species (n) rs;pwrsm;/

Sustainable (adj) a&&nxe;or;&aom/
Water cycle a&oo&m/

အဓိပ္ပာယ်ဖွင့်ဆိုချက်

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အင်္ဂေ.ပျံသည်/ /t&nrtaiVtjzpoajymi;vom;on/
မျိုးသုန်းပျောက်ကွယ်သော/ /tyi?w&pme? ti;qu?iu (o) tjcm;ou&wppwpc\ &ioeaexir v;0r&awmontcg/

မြေကောင်းမြေဆီလွှာဖြစ်သော/ /ajr^ajrqvmwi ajrmujrm;pmaom tm[m&"mwrsm;&jy;lu;xm; oermaomtyirsm;u &ioeapaom/
အစားအသောက် မဖူလုံမှု/ /tpm;tpm vvavmuavmur&&r/
လောင်စာ/ /Epoe;aygi;rsm;pmuyi aoq;contyirsm;\ &ylui;rsm;rxw,aom ausmur;ao;? a&e?(o) obm0"mwai/

ကမ္ဘာကြီးပူနွေးလာမှု/ /revtr"mwairsm;Oyrm-umAe'iatmuq'alumijzpay:aom avxEi or'&m tycsersm;jriwuvmr/
မှန်လုံအိမ်မောတ်ငွေ့/ /urmavxx&"mwairsm;raetycseu py,xm;jy;urmlu;yaE;vmatmi jyvyjci;rm urmajrlu;yaE;vmrujzpay:apon/ revtr"mwairsm;xwi umAe'iatmuq'?roe;?Eux&yatmuq'Eia&aiwyg0ion/

ကျက်စားရာနေရာ/ /tyi?w&pme? ti;qu(o)iuw\ obm0tavsmuaexionae&m
အပင်စားသတ္တဝါ/ /tyiwpcwn;uompm;o;aom ow0g/
လူသားတို့၏ပတ်ဝန်းကျင်/ /vom;rsm;wnaxmiaom{&,mjzpon jrirsm;?pu&rsm;?ri;rsm;Ei v,awmrsm;/
စိုစွတ်မှု/ /avxwi&on a&aiyrmP/

ရွှေပြောင်းနေထိုင်သည့်သက်ရှိမျိုးစိတ်/ /wpae&mra*[peptopwpcxo om;a&muaexijy; 4i;a*[pepu tE&m,jyEiaom ou&wprS;/

အမှိုက်တွင်း/ /wi;euwpcxwi trursm;pyxm;aomae&m/
လက္ခဏာရူပ/ /wnae&mwpcon tauwmraeí awmi (o) ajrmubuornrIuma0;onu wi;wmjci;/

ထုထည်/ /t&m0wkwpc\ yrmP/

ရုပ်ဝတ္ထု/ /ae&m,jy; xxn&aom rnont&m0wkrq/

မော်လီကျူးလ်/ / typEpp(o) Eppxuyaom tuwrrsm;u aygi;pn;xm;jci;/

မုတ်သုန်/ /awmitm&Ei ta&Dawmitm&wi &motajymi;tvalumi avwucwrvr;alumi; ajymi;jci;/arvEi puwibmvtlum;wi avon taemuawmibur wucwjci;alumi r;rsm;jy; atmuwbmvEi {jyv (ajcmuaoaom&mo) tlum;wi ta&Dajrmubur wucwon/

ကနဦးနေထိုင်သည့်မျိုးစိတ်များ/ /4i;aexi&mae&ma'o& a*[peptwi;ü rvwn&&ioeaom ou&rs;pwwpc/

သဘာဝပတ်ဝန်းကျင်/ /urmay:wiobm0tavsmujzpay:aom ou&ourtm;v;/

သဘာဝအရင်းအမြစ်/ /1) obm0tavsmuwn&jy; 2) vom;wutus;jyDaom t&mrsm;tm;v;/ 0yrm-a&?opyi?avmipmq?Ei a&rsm;yg0iygon/

နိုက်ထရိုဂျင်သံသရာ/ /avx?ajrx?tyirsm;Ei w&pmersm;(tyiupm;o;on) rwqi tqurjywom;vmvnywon Eux&*siEi 4i;aemu avxxo wpzejyevna&mu&jci;/

အာဟာရ/ /ou&rs;pwwpctou&ioe&evtyaomtpmtm[m&ujznqn;ay;ont&m/

အစုံစားသတ္တဝါ/ /tyiEi w&pmeEpcv;upm;o;aomow0g/

အော်ဂဲနစ်/ /obm0tavsmujzpay:aom wppwpc/atm*epv,,mpuys;a&;wi "mwajrDoZmrsm;Ei y;owaq;rsm;ryg0iyg/

အောက်ဆီဂျင်သံသရာ/ /atmuq*sion avx?tyirsm;?w&pmersm;Ei ajrrsuEmjyi tay:,vmrwqi tqurjywa&vsm;onjzpp0/

အိုဇုန်းလွှာ/ /aervmontE&m,&aom"mwa&mijcnrsm;urmajrDu;ay:oa&mu&rom;atmi umu,ay;on avxtwi;&tvmwpc/

ဓာတ်ငွေ့ဂုဏ်သတ္တိပြဇယား/ /"mwj'ypirsm;tm;v;u 4i;w*Powtvu tptp0wus p&xm;onZ,m;/

အပင်တို့အစာချက်ခြင်း/ /tpr;a&mi&aomtyirsm;raea&mijcn?umAe'iatmuq'Ei a&wu tpmtjzpajymi;vonjzpp0/

ညစ်ညမ်းမှု/ /obm0yw0e;usiuxcuapEiaom(o) tqytawmujzpapaomt&mrsm;/

အသားစားသတ္တဝါ/ /tjcm;w&pmersm;utrvuowjzwpm;aomuaomow0g/

ကာကွယ်ထိန်းသိမ်းသည်/ /wppwpcu 4i;\rvtajctaetwi;wn&apDy; rysup;ap&e umu,xe;or;on/(0yrm?opawm(o) awm&i;w&pmee,ajrrsm;)

သားကောင်/ /tjcm;w&pme(tom;pm;ow0g)w\owjzwpm;aomujci;uc&onom;aumi/

အဖန်တလဲလဲအသုံးပြုနိုင်သည့်စွမ်းအင်/ /ruece;aompr;tit&i;tjrprsm;jzpon av(o)aepr;ti/

မျိုးစိတ်များ/ /wpcEiwpcwnr&on ou&ow0gtyp/rs;pwwou&rsm;on rs;E,op(qvonrm om;or;rsm;) utwwuar;xway;Eion/

ရေရှည်ထိန်းသိမ်းရသော/ /wppwpcu 4i;\rv twi;xe;or;jci;? jyiyrunaxmuyrrvb wn&Eir/

ရေသံသရာ/ / urmajrlu;\ or'&m? a&cs? avxEiue;ajrwtlum; a&Uvsm;ajymi;vaom a&oo&mpu0e;/

References

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4 Page 15	Picture: 1	By Thomas Geissman and from http://news.bbc.co.uk
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Page 27	Text: What Happens When a Chemical is Added to the Food Web?	Adapted from: https://www.nwf.org/Wildlife/Wildlife-Conservation/Food-Webs.aspx
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Page 71 and 72	Extra 1: Globally threatened species in the indo-Burma hotspot	Indo-Burma Biodiversity Hotspot by Critical Ecosystem Partnership Fund, 2011 Update, Page 29

ENVIRONMENTAL SCIENCE BASICS

Student's Book

Environmental Science Basics is a course book designed for Myanmar adults who are interested in environmental studies or would simply like to have a better understanding of the world they live in. The course equips each student with an introduction to essential environmental concepts and issues as well as practical skills to promote a healthy environment.

Lessons in intermediate English range from food chains and the earth's cycles to Myanmar's own natural environment and the challenges facing it. While Environmental Science Basics is designed for a taught course that takes 22-30 hours, it can also be used as a self-study resource.

The Student's Book contains:

- 10 lessons, each with readings, activities, and discussion questions
- A Projects Package with extended assignments
- A Glossary with definitions and translations

The Teacher's Book contains the above components as well as supplementary materials and detailed explanations.

Environmental Science Basics differs from the traditional science textbook by promoting experiential learning in the form of practical activities such as observation, experimentation, and research.

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