Practical Tools for Schools

1. ABOUT THE Flipchart:

This flipchart is designed to be used by teachers & facilitators during relevant school and/or Eco-club classes.

The flipchart consists of 6 modules: 1. Weather, 2. Water and Sanitation, 3. Waste and Sanitation, 4. Energy, 5. Conservation & Biodiversity and 6. Livelihoods.

Each module has 3 pages. The first page contains the module theory. This has background information to assist teachers. Then there are 2 pages of activities relevant to that topic. There are suggested times allocated to each activity to help you plan the class.

- On the front of each page is the illustration for the students to see. It also contains diagrams for the activity pages.
- On the back of the pages is an OBJECTIVE to give you some context for the lesson. There is also BACKGROUND INFORMATION, which gives facilitators some general knowledge. You may want to use some of this information in your discussion but we don't suggest you just read this text out. Also on the back of pages are the DISCUSSION POINTS which you should read out to stimulate class discussion.

KEY

To make teaching easier each page has a key based on the following elements:


This refers to DISCUSSION POINTS and questions that should be read out and discussed with students


This icon refers to information that needs to be recorded on the large posters


Refers to handouts that should be given to students

2. BEFORE YOU START

- Before the class, the facilitator should read and familiarise themselves with the flipchart. Teachers should ensure they have the all the materials required to conduct the lesson.
- Organise the students around the flipchart, ideally seated in a semi circle . Ensure they all can see clearly.

3. DURING THE CLASS:

- Discuss the picture first, then share some of the relevant theory with the group. After this, on THEORY PAGES you can ask the questions. On ACTIVITY PAGES you can do the activities.
- Make the lessons and activities as enjoyable and practical as possible – people remember more when they feel happy.
- Try to get everyone to participate. If they are observing in one activity ensure they are more actively involved in the next activity.

LIVE&LEARN
Environmental Education

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We would like to thank the principal, teachers and students of Chhnok Trou and Kampong Luong Primary Schools for their assistance in testing these materials and also the local authorities in these areas.

CONTENTS

Fun Activities

40 minutes

WEATHER THEORY

To better understand weather and seasons, with specific reference to availability and cycles of water for rainwater harvesting.

BACKGROUND INFORMATION

Weather is the general term given to the changing conditions of the earth's atmosphere. It is affected by many factors including temperature, rain, air pressure, humidity, hours of sunshine, types of clouds, and amount of cloud cover. The main factor that allows the earth to have various weather conditions is the sun. The heat of the sun affects the atmosphere to create weather; for instance, heat from the sun causes water to evaporate, which can produce rain.

The following module includes activities that will help you to better understand the weather by monitoring some of the key factors that affect the weather. It is important that the measurements are taken at about the same time each day so that they can be compared. As such timing is one of the first things to decide.

Further activities have been provided to examine how weather affects our daily lives by influencing the availability of water – our most precious resource. Students can get involved in activities that plan to take advantage of the times when it rains to help provide good, clean and reliable drinking water all year round.

SEASONS

Cambodia has two distinct seasons – the wet and the dry. Dry season runs from November to April. In this time rainfall is at its lowest and temperatures are at their highest. During March - May temperatures can reach 95° f (35 degrees Celsius), especially south and central, while winter lows seldom fall below 50° f (10 degrees Celsius). November to January are cooler while February to April are hot and dusty. November is the coolest month, April the hottest.

The wet season runs from May to October due to the southwest monsoon, and brings some 75% of Cambodia's annual rainfall. July to September are the wettest months. There is often seasonal flooding in Phnom Penh and the rest of Cambodia in late-July and early-August.

Cambodia's weather revolves around monsoons, so rainfall is significant, with the heaviest amounts falling in the southeast, and mountainous coastal areas. Daytime humidity countrywide is near 60 percent, while in the evenings, 90 percent is quite common.

Students can use their knowledge gained through weather monitoring to discover the patterns in the weather, which form Cambodia's seasons.

IMPACT OF SEASONS

Sometimes in the wet season there is too much water and in the dry season there isn't as much water so the wells, rivers, streams, ponds, creeks, and swamps may become more polluted because as the water dries up, the wastes become more concentrated – yuk! Sometimes there isn't even enough water and this is called a drought.

The country's food production is also highly vulnerable to the effects of bad weather conditions, such as drought and floods. Weather, climate and water have a major impact on development of agriculture, fisheries and hence the economy. Accurate observations and predictions about weather, climate and water, are of vital importance.

Cambodian people rely greatly on natural resources for their livelihood. According to UNDP, four out of five Cambodians make their living directly from the water, fish and forests of their country. Weather conditions play a very important role in farming. The success or failure of farm crops depends on the weather. E.g. too much rain can drown a crop, whilst too little, hampers growth. Farmers must firstly think about the weather and seasons and then plan what crops to plant at what time of the year.

There is growing evidence that some human activities, and especially the production of lots of carbon dioxide are impacting the seasonal patterns of weather – this is known as climate change. As the climate changes it becomes more difficult to predict the best times to grow crops and the extremes of weather can become harsher. As such food crops may be impacted and seasonal flooding and droughts may become worse.

WEATHER & THE WATER CYCLE

One of the most obvious features of weather is the rain. Rain is an important part of the water cycle: the constant recycling of water. Rain can fall in many places and the rainwater can soak into (infiltration) the ground and become groundwater, or become run-off and flow into streams, ponds, rivers, lakes and even the ocean. Rivers oceans, lakes and even glaciers are important storage areas for water. Any water that is on or near the surface can be heated by the sun and rises up into the atmosphere as evaporation, some of the moisture in plants can also heat and rise through transpiration. The water that rises into the atmosphere forms clouds and when it rains the process starts all over again.

THE AVAILABILITY OF WATER

Approximately 97% of all water on the earth is salty, generally people cannot use this water for drinking, growing food or industrial purposes. The remaining 3% of water on earth is fresh water, however much of this is locked up in ice at the poles, or found beneath the ground where we cannot get access to it. Only a very small proportion of the water on earth (about 0.003%) is fresh and available for humans to use. The availability of this water is very closely related to the weather, because rain and surface water run off provide our main ways to access this resource. Therefore, we all have a responsibility to take care of our fresh water supplies. To maintain healthy water supplies we need to keep it free of pollution and contamination, and use less of it (don't waste it). There are many ways that people can take better care of water.

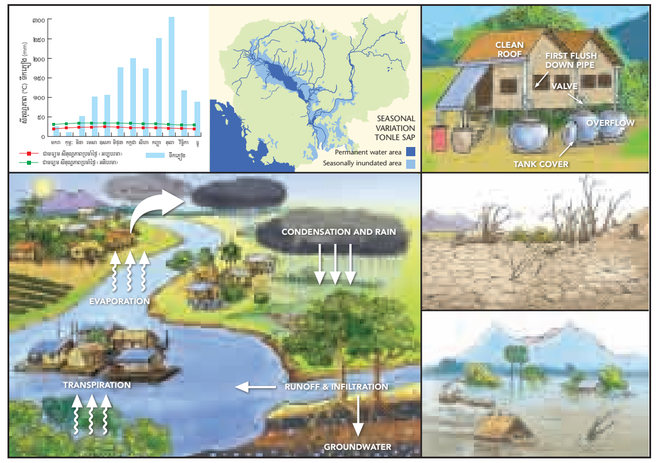
RAIN WATER HARVESTING

What is rainwater harvesting?

It means capturing rain where it falls or capturing the run off from roofs of buildings in your village, and storing it so that it can be used. Rain is the first form of water that we know in the water cycle, hence it is a primary source of water for us. Rivers, lakes and groundwater are all secondary sources of water.

We need to understand the weather to plan for rainwater harvesting. In the wet season we can harvest the rainwater to store in rainwater tanks. If our roofs and storage tanks are kept clean the rainwater will also be very clean, and is a perfect source of water for drinking. A clean and well-maintained rainwater supply should not require boiling before you drink it! Rainwater is less exposed to pollution or contamination than rivers and lakes. Using rainwater for drinking is a very healthy choice and can avoid exposure to many diseases that cause diarrhoea, and serious illnesses that can even lead to death.

It is an advantage if we can maintain our storage of rainwater to last through the dry season. In the dry season we often find it difficult to find enough water, especially in the rural communities. At these times the water that is available can become very polluted. Therefore it is an advantage to harvest as much water as possible in the wet season and use it wisely so that it doesn't run out. Rainwater should be used only for drinking, because poorer quality water can be used for cooking or washing.



DISCUSSION POINTS

A. What do you see in this picture?

B. Why is weather important (temperature, wind, rain)?

C. What are the effects of bad weather?

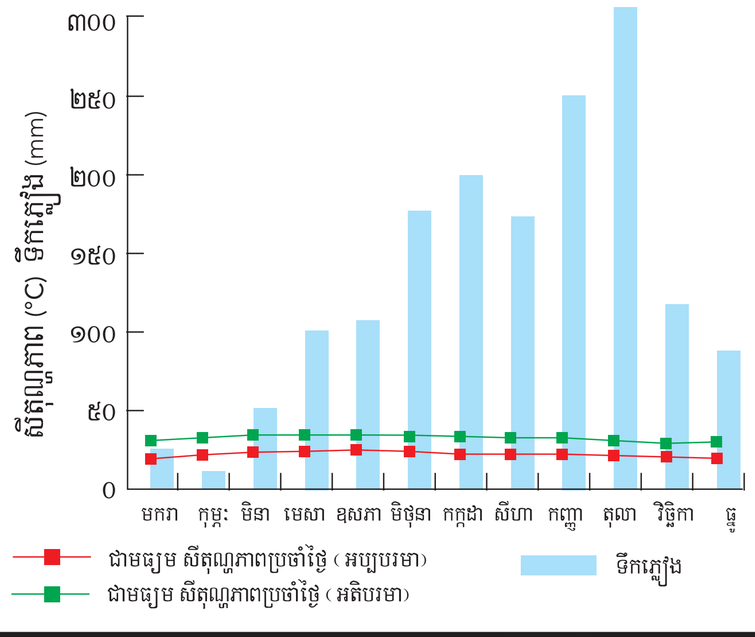
D. What is the water cycle and why is rainwater important?

E. What are your local seasons? Why is knowing about seasons important to us?

F. Why is rainwater likely to be cleaner and safer than river or well water?

G. How could you make a supply of rainwater last longer?

H. Do you have any ideas or something to add?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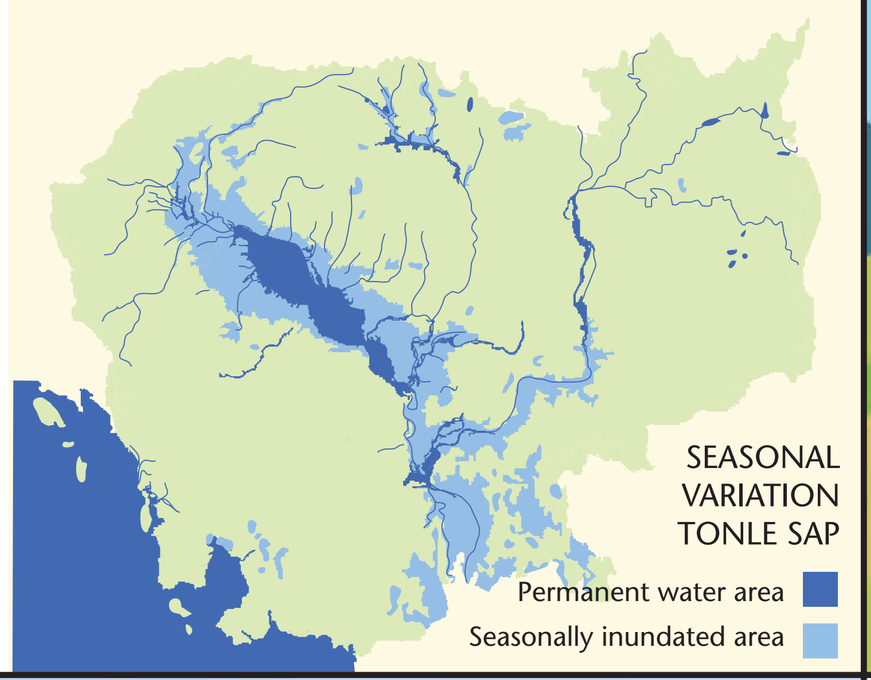
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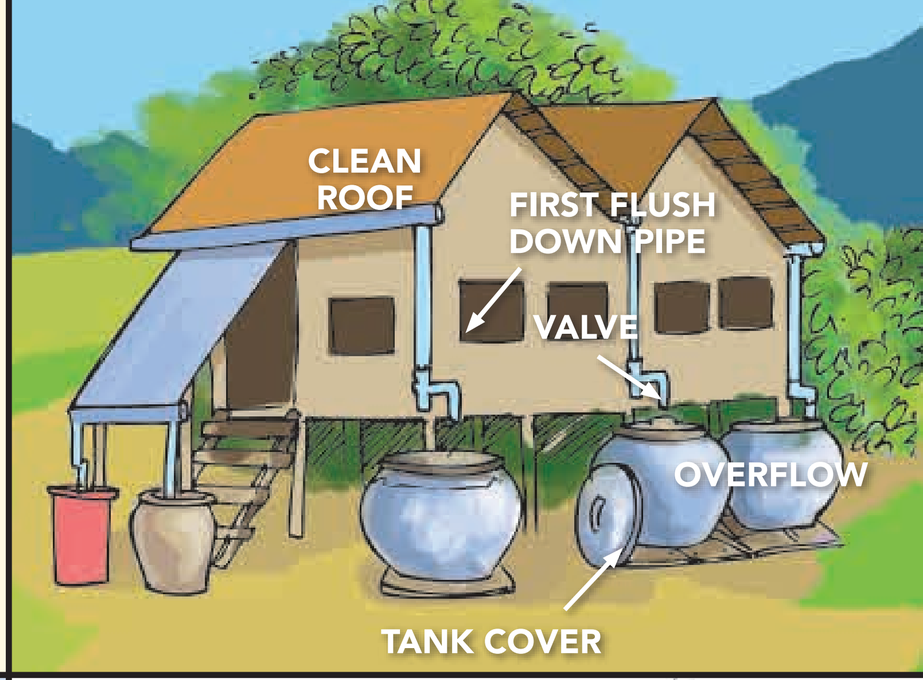
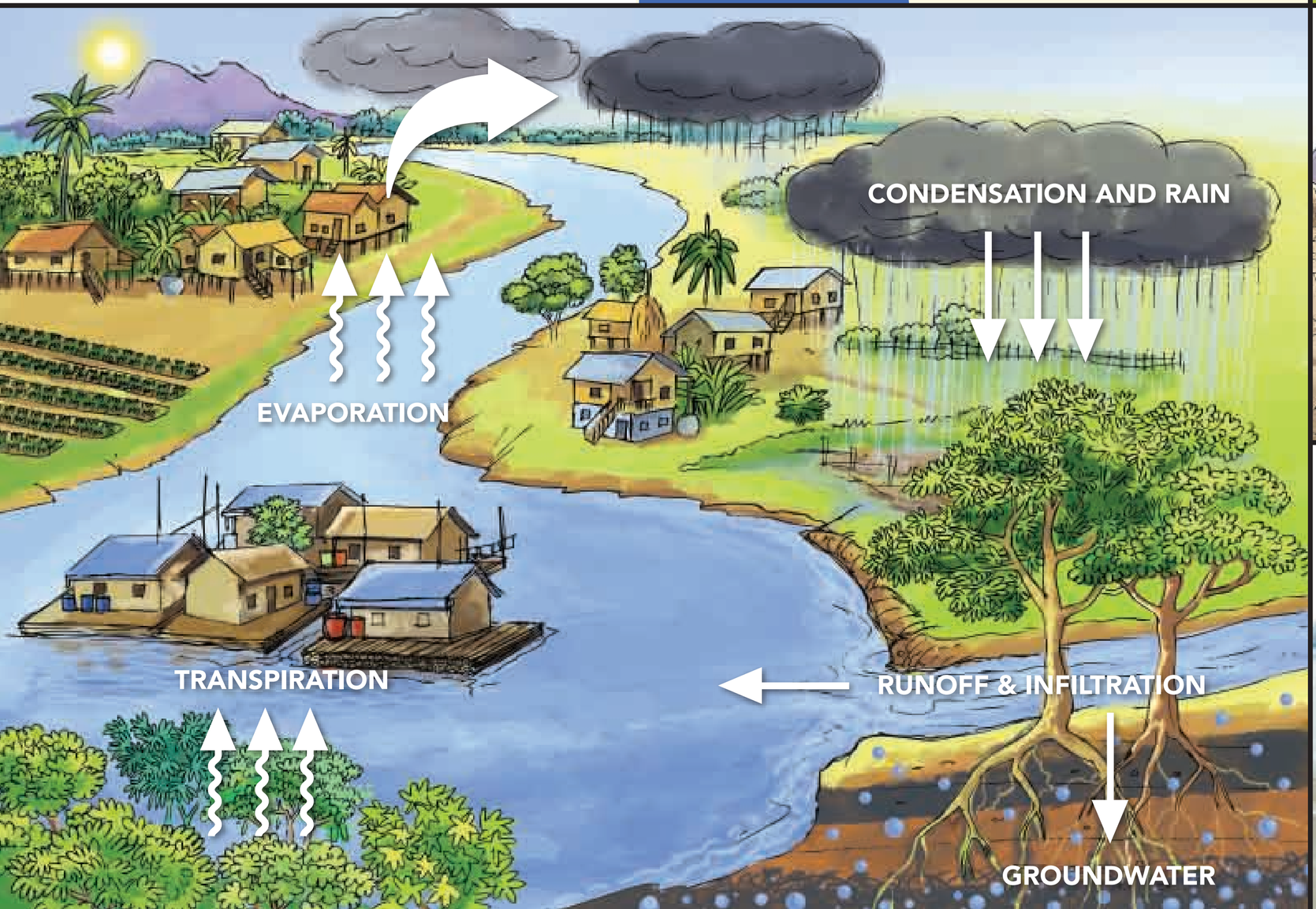
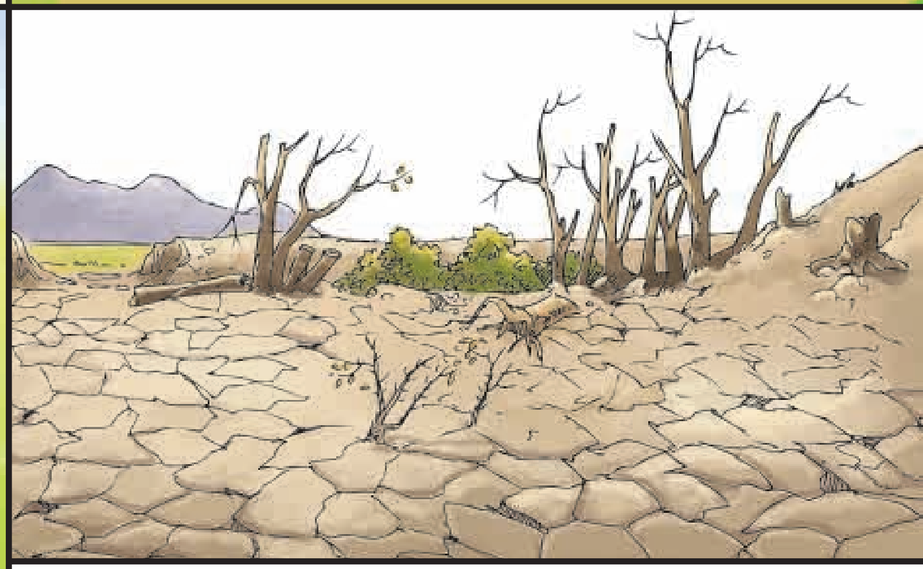
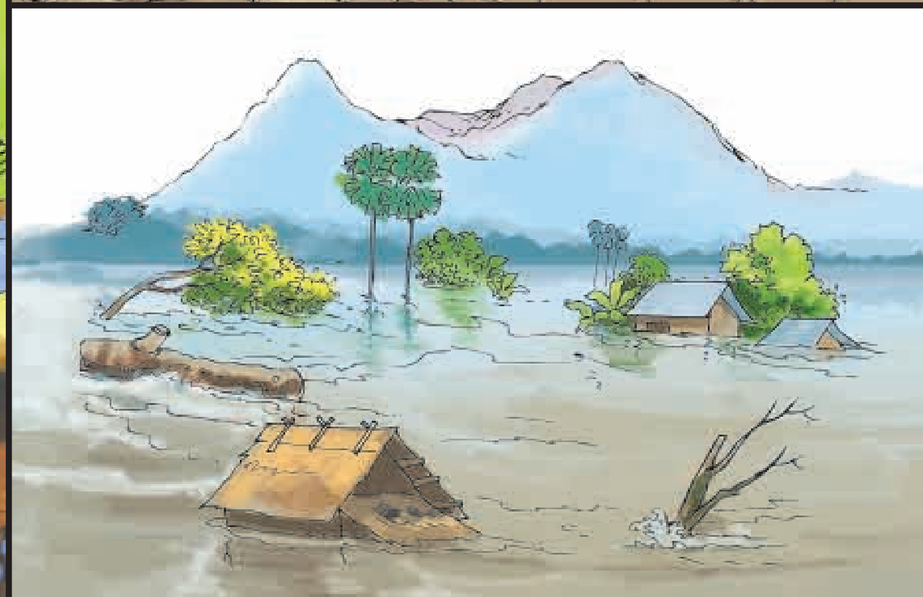
Permanent water area
Seasonally inundated area


CLEAN ROOF
FIRST FLUSH DOWN PIPE
VALVE
OVERFLOW
TANK COVER


CONDENSATION AND RAIN
EVAPORATION
TRANSPIRATION
RUNOFF & INFILTRATION
GROUNDWATER





WEATHER ACTIVITIES: MONITORING THE WEATHER

Grade level: from grade 4-8

OBJECTIVES:

After these activities student can:

- understand the changes of weather every day and relationship between temperature, wind, rainfall, and season and its affect to daily life

30 minutes then ongoing

ACTIVITY 1: Sundial and Compass

Material: Flag pole with flag (if not available need to find exposed area to place a straight pole up in the air), rocks or paint, and a watch or clock.

Action:

1. Ask students to go outside the class and observe the direction the shadow is pointing to – if it is in the morning this is West, if it is in the afternoon this is East. During the day the shadow makes a straight east-west line – making the North-South line is simple geometry - once you know East and West you can identify where South and North are.
2. Throughout the day place a rock or mark the ground for each hour indicating where the shadow falls at that time. Depending on your time you may have to place rocks over a couple of days before your sundial is complete. Now your sundial is ready to use. When you want to tell the time just look at where the shadow is pointing. In the picture the stones are to mark each hour from 6am to 6pm. The picture shows the time of 9am. The time may need to be adjusted a little depending on the time of the year as the sun moves slightly during the year.

Theory: As the Earth revolves around the sun at a constant speed from, sunrise to sunset, shadows of buildings, trees and other objects move slowly, but continuously. On the Earth, the sun rises in the East and then sets in the West, moving across the sky in a predictable way. In the northern hemisphere, shadows cast west in the morning north at noon-time and east in the late afternoon. Knowing the direction of shadows is very helpful for telling the time and the directions.

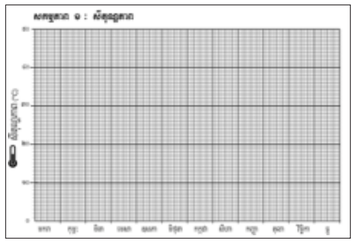
Teacher's note: This activity links with the wind direction activity. It may be helpful to mark out the major compass bearings and times on the ground, below the flagpole, to give the students a easily recognizable sense of direction. e.g. N, S, E, W, SE, SW, NE, NW and understanding of the time.

10 minutes then ongoing

ACTIVITY 2: Temperature

1. Fix the thermometer to a wall in a safe place in the classroom.
2. Demonstrate to students how to measure the temperature using the thermometer.
3. Organise for students to check the thermometer at the same time each day and write down the results. Enter this data on the large wall chart/graph (see example below). Display this large graph on the classroom wall. Discuss any patterns that may appear over time. Are the days getting hotter or colder?

Teacher's note: When the sun is closer it can heat up the earth more. Factors such as cloud cover or forest cover can influence the temperature. Large areas of water (e.g. the ocean) tend to moderate changes in temperature as water is slower to change temperature than air.



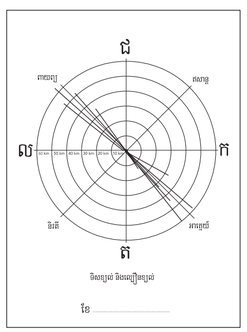
10 minutes then ongoing

ACTIVITY 3: Wind direction

Material: Flag pole with flag (if not available need to find exposed area to place cloth to blow in the wind) record book and weather monitoring worksheet

Action: Ask students to go outside the class and stand around the school flag. Look at the shadow, if it is morning the shadow will point to the West and if it is afternoon the shadow will point to the East – get the students to mark a line from East to West and place a rock in each direction. Then place a transecting line to show North & South (as shown in the diagram). When the flag is pointing south it means that the wind is coming from the North. If the flag isn't moving then there isn't any wind. If you know there is wind but the flag isn't moving there is a problem – maybe it is wet or tangled. Can you look at anything else to identify wind direction?

Reporting: Write down the direction of the wind at the same time each day. (nominate 2 students to do this for the rest of the week, when not eco-class day) Each month graph the results. Is the wind coming from the same direction? Is it getting windy more or less often? Is the wind direction changing?



Theory: Heat from the sun warms the air, which rises and creates areas of low pressure. Wind is the movement of air from high-pressure areas to low-pressure areas in the atmosphere.

Teacher's Note: This activity links with the sundial activity, which gives more explanation about finding directions with the sun. It may be helpful to mark out the major compass bearings on the ground, below the school flag, to give the students a easily recognizable sense of direction. e.g. N, S, E, W, SE, SW, NE, NW

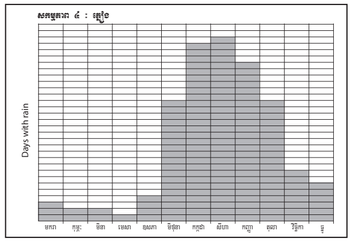
10 minutes then ongoing

ACTIVITY 4: Rainfall

Pin up the large rainfall chart on the classroom wall. When it rains, organise for students to record the rainfall on this chart, by colouring one box each day that it rains. (see example below, your chart may look similar to this)

Over time, discuss the results with the class. Is the rainfall increasing or decreasing? Is there a pattern? Can you predict what will happen next week or next month?

Teacher's note: Heat from the sun causes water to evaporate. Transpiration is the movement of water from the ground through the plant roots up into to the leaves and out to the air. The moisture in the air, from evaporation and transpiration, accumulates and can produce rain.



Monthly

ACTIVITY 5: Seasons

When you have collected, recorded and graphed measurements of rainfall, wind and temperature for a long period of time (several months or longer), you will be able to make some observations about trends and seasons.

Compare the graphs of rainfall, temperature and wind. Ask the students to observe patterns between the graphs. Discuss the observations with the class. How does rainfall relate to temperature and wind? What relationship does temperature have with rain? Why could high temperatures lead to rain?

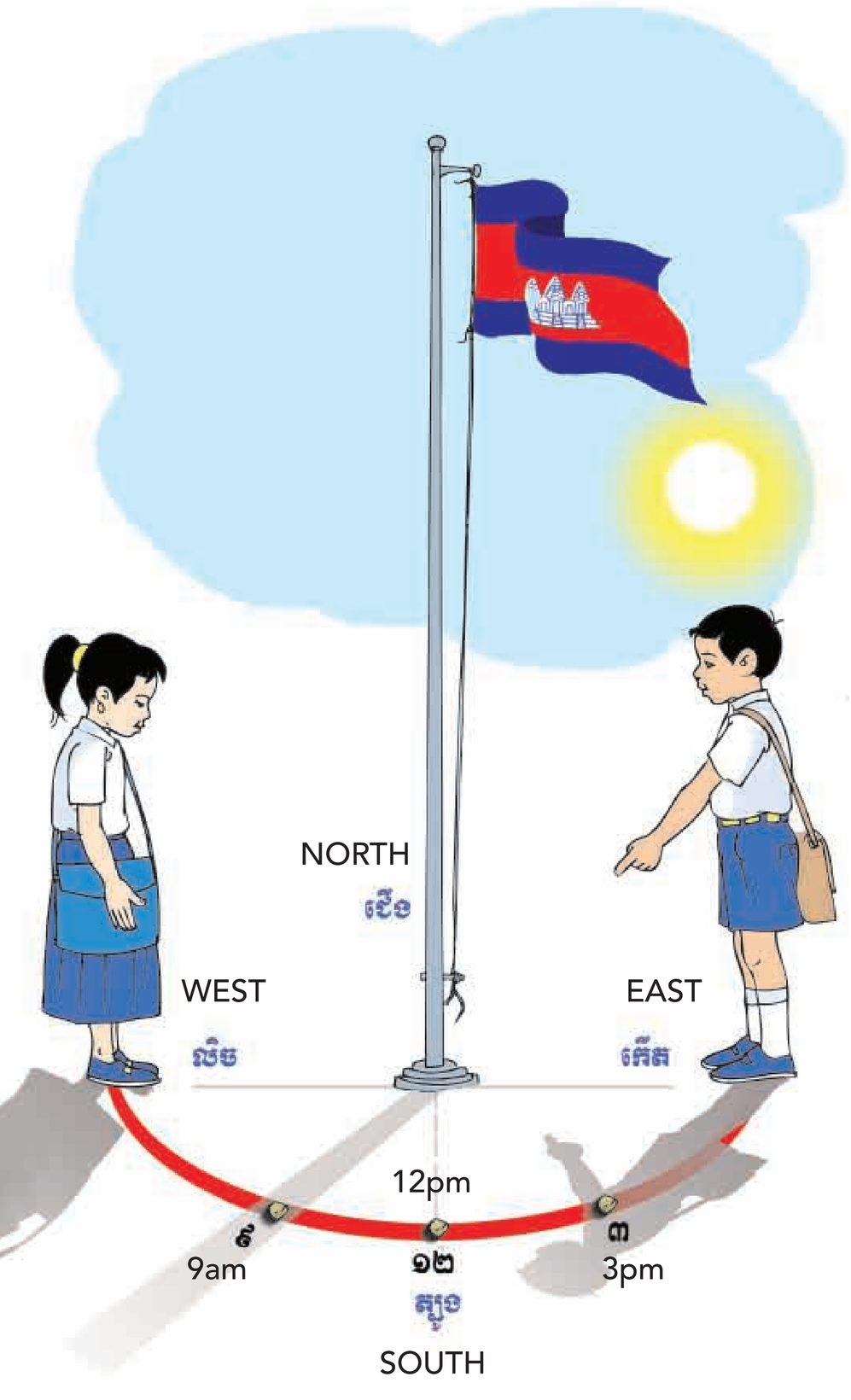
Observe seasonal patterns over time and discuss with the class. What time of year is it hottest and driest? What time of year does it rain the most?

Use the observations to draw some conclusions about the weather and its effects on the life of Cambodians.

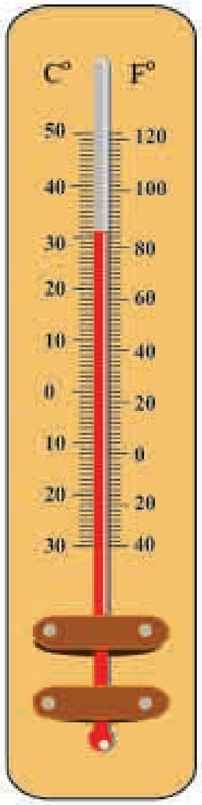
- What time of year is the best time for planting crops such as rice?
- What would happen if the rain does not fall when expected?
- When would we be most likely to experience water shortages?
- What could we do to prepare ourselves for a water shortage? How could we make sure that we have enough food and water to get through a dry period?

Teacher's note: Temperature, wind and rainfall all relate to each other, each one affecting the other. By observing the patterns, weather can be predicted and climate defined. Seasons are defined by the weather patterns. Seasons vary based upon the location on the earth. All areas have seasons but areas that are further from the equator have greater changes in seasons. An understanding of weather and climate allows us to prepare and plan for the future.

ACTIVITY 1: Sundial and Compass

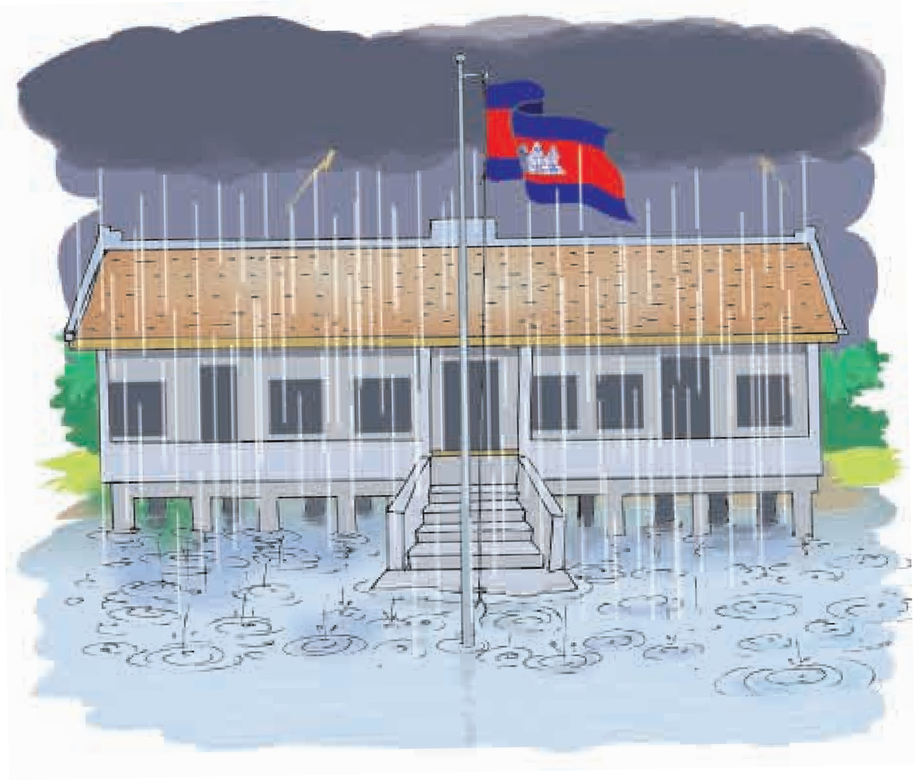


ACTIVITY 2: Temperature

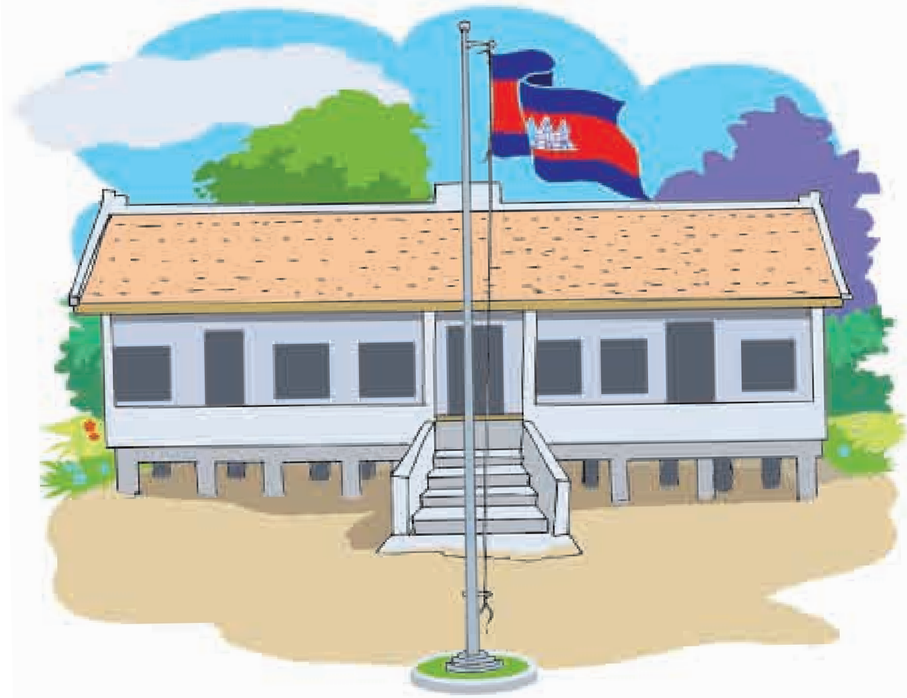


ACTIVITY 3: Wind direction

ACTIVITY 4: Rainfall



ACTIVITY 5: Seasons



WEATHER ACTIVITIES: CATCHING THE RAIN

Grade level: 4, 5 and 6

Materials: Paper, pens or coloured markers, flipchart picture (page 9)

OBJECTIVES:

After these activities students can:

- invent/design/draw and describe a picture of rain water collection system
- interest in collecting rain water at school/house to last through the dry season
- decide which water source should be kept for drinking, cooking, washing

MAIN IDEAS:

The activity is about how weather patterns affect the availability of water for people to use. Water may be abundant in the wet season, but then hard to get in the dry season. There is also a connection between the amount of water and its quality. When the water dries up in the dry season it often becomes more polluted because waste materials in the water become more concentrated. Rainwater tanks are one way of getting a clean supply of water for drinking. To make the rainwater supply last through the dry season, it should only be used for drinking, water of a lower quality can be used for cooking and washing.

45 minutes

ACTIVITY 1:
Rainwater harvesting

1. Show the students the picture of the community that is harvesting rainwater. This picture is on the opposite side of the flipchart.
2. Organise the students into small groups of 4 or 5. Tell each group that their challenge is to design a rainwater collection system. They don't need to be an expert to do this, and they don't have to actually build it. Provide each group with a paper and pens or coloured markers. .
3. Assist the students by giving them suggestions and allow them to look at the examples in the flipchart.
4. When each group has finished, ask them to present their design to the rest of the class. Encourage the other students to ask questions and to make comments about the design
5. Ask the students the following questions and encourage them to share their opinions.

QUESTIONS:

a. What is happening in this picture?
b. What times of the year could people collect the rainwater?
c. Which source of water is more likely to be safe to drink, rainwater, or water from the river?
d. Which water sources are polluted or contaminated?
e. How is the rainwater protected from being contaminated by waste and pollution?
f. What might happen to the supply of rainwater in the dry season? How could people make the supply of rainwater last longer?
g. In the picture, what do the people collect the rainwater for? Why would you use rainwater for drinking but other sources of water for cooking, bathing or cleaning?
h. Ask your students if anyone in their village collects rainwater?
i. Ask the students to imagine what it would be like if their own school or village captured, stored and used more rainwater. What would the village look like? What changes would be likely to happen?
j. Would this be realistic in your village? (Why or why not?)

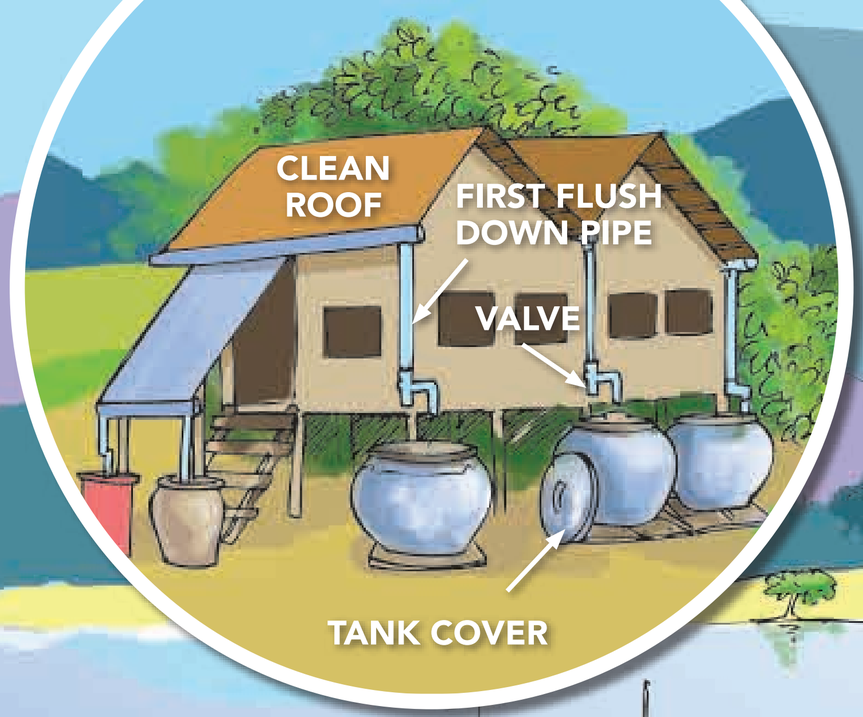
Teacher's notes: *The activities aim to raise students' awareness of the value of rainwater as a supply of drinking water, and to recognise that its availability is affected by the seasons. When the students design their rainwater tanks, it does not matter if their design is 'right' or 'wrong.' The main objective is to encourage them to be creative and to think about how to solve a real life problem. It is very important to encourage and nurture creative thinking and problem solving skills from a young age. Assist the students with their designs and ideas, but don't be too critical. Especially encourage ideas that are imaginative!* the teacher can also ask the student to design the rainwater harvesting at their home.

Rainwater collection systems could include the following:

- A gutter that catches water that would otherwise run off the roof
- A pipe that runs from the gutter to a storage tank or vessel
- A storage tank or vessel; this should be as large as possible and could be a concrete, metal or plastic tank. It could also be a large ceramic pot
- Cover for storage tank

Rainwater collection and storage should also be protected from contamination (e.g. animal droppings, leaves and mosquitos etc). To protect the water quality, students could be encouraged to include the following in their designs:

- All storage vessels (tanks, pots etc) should have a well-fitted lid that keeps unwanted animals out
- Roof surfaces that are used to collect water should be clean and free of debris such as leaves
- Trees or branches that overhang surfaces used to collect rainwater should be removed
- It is a good idea to have a downpipe (the one that connects the roof gutter to the storage tank) that is not permanently connected to the storage tank. This way the dirty water that may come from the roof when the rain first starts (the 'first flush') can be diverted away from the tank. After 5 or 10 minutes of rain the downpipe can be connected to the storage tank.


CLEAN ROOF
FIRST FLUSH DOWN PIPE
VALVE
TANK COVER

60 minutes

WATER & SANITATION THEORY

To identify the importance of water with emphasis on drinking water and how it may become contaminated and polluted.

BACKGROUND INFORMATION

Water is a simple molecule that consists of one oxygen atom and two hydrogen atoms. (An atom is the smallest component of an element having the chemical properties of the element.) Water molecules like to stick together, but don't like to be squeezed into tight spaces. At different temperatures water has different properties. It is most commonly a liquid but can turn solid when very cold (ice), and when very hot it can become a vapour. Living things cannot survive without water. Water is a necessity for life. An average person needs 4 litres of clean water to survive – this is not surprising given that 70% of our bodies are actually made up of water!

Being such a necessity, an insufficient supply of safe drinking water or contaminated drinking water, poses a threat to all living organisms and especially humans. Humans can survive for several weeks without food, but for only a few days without water. A constant supply is needed to replace the fluids lost through normal daily activities, such as breathing, sweating and urinating. Water of sufficient quality to serve as drinking water is called **potable water** whether it is used as such or not. Water that is not harmful for human beings is sometimes called safe water which is not **contaminated** to the extent of being unhealthy.

What is water? Water is a simple molecule

WHAT IS WATER?

There are four main sources of drinking water

a. Rivers and streams

   Our rivers and streams can originate from springs (water coming out of the ground from the top of an aquifer), or from rain water runoff from the mountains and hills draining to the lowest point of the land.

b. Bores and ground wells

   Bores and ground wells are holes drilled or dug down to aquifers, or natural stores of water, under the ground (ground water).

c. Rain water is water collected in storage tanks usually from a structure built by people, for example a corrugated iron roof is often used to collect rain water

d. Piped water comes from springs, rivers or underground wells.

WATER POLLUTION

The main problem for people is access to clean water. For example, toilets often go straight into our waterways, and many people and animals use waterways as their toilet. Unfortunately, lakes and rivers polluted with sewage are often the only source of water in the local area.

Rubbish and chemicals also contaminate water, these may come the communities where we live or from industries. Wastes that enter water sources can have potential health impacts and cause other environmental problems.

WATER CAN CARRY DISEASE

The World Health Organization estimates that 80% of all sickness and disease in the world is a result of poor quality water and sanitation. 2.2 million people: mostly children die from diarrhoea every year in developing countries.

A big problem facing people is that although we all need water, unclean water can contain germs or microorganisms that may cause disease. Some of these little organisms can make you very sick, and in severe cases lead to death. They are especially dangerous for small children or the elderly. Water that does not look dirty is not necessarily safe for humans to drink. Contamination of drinking water is sometimes hard to see because the germs and bacteria that cause diseases cannot be seen with the naked eye. You could fit more than a million disease causing germs in one single drop of water! So, you cannot assume that water is safe just because it is not dirty or does not have a bad smell.

If drinking water comes from a polluted source and is untreated it may contain germs and bacteria that can cause the spread of water-related diseases like diarrhoea, dysentery, typhoid and cholera. Contamination can occur when human and animal faeces enter the water source.

If someone does get bad diarrhoea, drinking clean (bottled) water with some sugar and a tiny bit of salt added to this, can help reduce dehydration

HOW DOES OUR DRINKING WATER BECOME CONTAMINATED/POLLUTED/ UNSAFE?

How does our river water become contaminated?

Our rivers often become contaminated when people forget how important clean water is to sustain life. When houses and villages move too close to the water then the water tend to get polluted. Gardens planted alongside the river cause erosion and run off into the river. A lack of toilets sees waste go straight into the water, contaminate ground water that runs into the river, and soap and detergent also cause pollution. People often throw rubbish into the water or burn rubbish near water, which produces a toxic chemical that settles on top of the water. All this quickly makes water unsafe to drink.

How does groundwater become contaminated?

Some groundwater contamination occurs naturally. Saltwater intrusion occurs when too much fresh water is pumped out of the aquifer and saltwater from the ocean is drawn in to replace it. Serious contamination usually occurs because of human activities. This contamination includes the runoff of agricultural pesticides, synthetic organics from household cleaning products, and petroleum and metals from roadways. Leakage of bacteria from septic systems, and bush toilets, also creates a serious hazard to groundwater purity. Most of these pollutants enter the aquifer through water draining from the surface. Since groundwater moves slowly, it may take many years for a pollutant to be detected.

Rain water

Most people think that rainwater is always safe to drink. That in fact may not always be the case. This will depend on how safe the tank or storage container is. If rain water is collected from roofs, then these roofs and their gutters and the storage container all need to be kept clean.

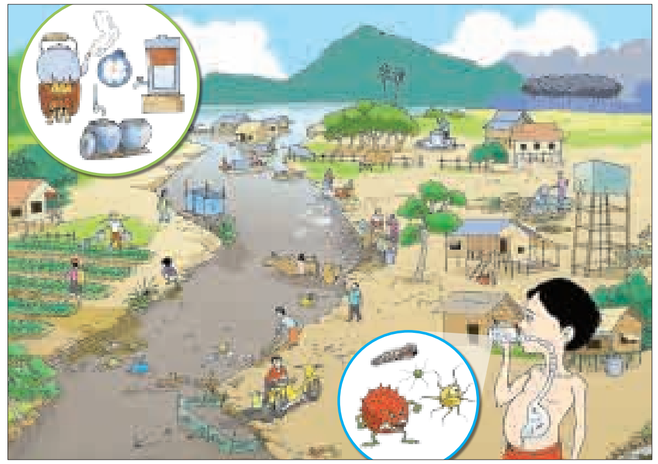
HOW CAN DISEASE ENTER OUR BODY?

Disease can often come into our body through unsafe food or water and unclean hands. Before eating food and drinking water make sure that it is safe enough for eating and drinking. Before touching food make sure that your hands are clean and if not wash them with clean water and soap.

When do we wash our hands?

- After using the toilet
- After changing the diaper-wash the baby's hands, too
- After touching animals or animal waste
- Before and after preparing food, especially before and immediately after handing raw meat, poultry or fish
- Before eating
- After blowing your nose
- After couching or sneezing into your hands
- Before and after treating wounds or cut
- Before and after touching a sick or injured person
- After handling garbage

Drinking water needs to undergo a process of purification. e.g. boiling constantly for 15 minutes or using a ceramic water filter. Other solutions are to protect water sources through management of human waste, livestock waste, rubbish and chemical waste. Ensuring there are trees around water sources is also important as trees act as a natural filter to protect the water source.



DISCUSSION POINTS

A. What does this picture show?

B. Why is clean water important?

C. Where does our drinking water come from?

D. How does our water become polluted or contaminated?

E. Is your water / drinking water polluted? If so, how do you think this happened?

F. Why is it important to wash your hands with clean water and soap?

G. How can we make our drinking water safe and our water sources cleaner?

H. How should you make our water clean and safe?

WATER ACTIVITIES: TESTING THE WATERS

Grade level: 4, 5 and 6

Materials: Water from a typical local water supply, boiled water, bottled water (purchased from a store), ceramic filter, hand-washing soap, H_2S water test tubes.

OBJECTIVES:

After these activities students can:

- To show the importance of safe drinking water
- Gain the practical experience and knowledge of doing a water safety audit and water testing
- Develop record keeping and analytical skills
- Take responsibility for their own family water hygiene

MAIN IDEAS:

Water can be contaminated by disease causing germs, such as bacteria and viruses, which are introduced into the water through pollution and disposal of our wastes. Water that does not look dirty, may still be contaminated my millions of germs that we can't see with our naked eyes. Simple water tests can tell us whether or not the water is contaminated and safe to drink. Boiling water, using ceramic filters and washing your hands with soap are all ways to remove or kill germs so that water is safer for drinking.

---

30 minutes

ACTIVITY 1:
Dirty hands!

Explain to students that through out the day you accumulate germs on your hands from variety of sources, such as direct contact with people, contaminated surfaces, foods, even animals and animal waste. If you don't wash your hands frequently enough, you can infect yourself with these germs by touching your eyes, nose or mouth. And you can spread these germs to other by touching them or by touching surfaces that they also touch, such as doorknobs.

1. Ask the students to stand in a circle to conduct a demonstration.
2. Get one student to dip their hands in a container of water.
3. Then ask that student to shake the hand of the person standing next to them in the circle. This person will then also have a wet hand.
4. Repeat the process and allow the handshake to proceed around the circle. How many people ended up with a wet hand? What could happen if the first person has germs on their hand? How many people now have germs on their hands?
5. Carry out a demonstration about how our hands can carry germs and how washing hands with soap can eliminate these germs.

20 minutes then ongoing

ACTIVITY 2:
Is my water supply safe to drink?

1. Divide the class into four or five groups and provide each group with a H_2S water test tube. Each group should number or name their test tube so that they can identify it later. Allocate each group to test a different source of drinking water; this should include bottled water (purchased from a store) and water from a number of usual local sources, which may include:
   - Water storage tank
   - River, lake or pond
   - Well or bore
   - Tap (piped water source)

   Each group will test one sample of water using the H_2S water test tubes.

   The H_2S test is a simple test that will tell you if the water being tested is contaminated. The test identifies if hydrogen sulphide (H_2S) is in the sample. A type of bacteria that lives in the gut of humans and animals produces H_2S. If it is found in the water it means that harmful bacteria or viruses could also be in the water. If the water being tested changes colour, this means that hydrogen sulphide is present, and also indicates the likely presence of bacterial contamination by faecal coliform in water.
2. Follow the **Using the H2S Test** instructions as shown on this page, to undertake the tests.
3. Then discuss the results with the class. You can ask also the following questions

QUESTIONS:

a. Could you predict which water samples would be contaminated? How?
b. Why can water be clear and still be contaminated?
c. Where could the contamination come from around here?
d. What could we do to prevent water being contaminated?
e. What could we do to prevent illness if we have to drink water that comes from contaminated sources?

USING THE H_2S TEST

Step 1:

Collect the water sample. Leave the lid on the sample bottle until immediately before you collect the water sample. Never touch the inside of the sample bottle, or it will be contaminated and not provide an accurate result. When collecting from a tap you should allow it to run for about 15 seconds before collecting the sample. When collecting from a well or bore, you may need to collect water in a container such as a bucket first. Fill the sample bottle to just over ¾ full and replace the lid immediately.

Step 2:

Place the water samples in a dark place at room temperature. Check your test sample at the same time each day for 3 days for changes in colour. Record the date and time for each observation and your result for each day. The test will change colour if bacteria is present, see the H2S Colour Code below, to indicate the degree of contamination.

20 minutes then ongoing

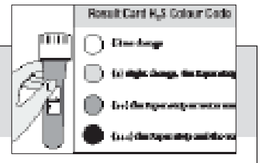
ACTIVITY 3:
Ceramic filters purification

Undertake this activity as a demonstration to the class.

1. Take a sample of water from a source that has been identified in Activity 1 as contaminated.
2. Pour the water into the ceramic filter, collect the water after it has been filtered and re-test to see if it is still contaminated. (Use the method as in activity 3)

Teacher note: *Two processes are at work. Because the mixture of rice and clay has small micropores: parasites, amoebas, and large bacteria cannot flow through these micropores. Simply put, water can fit through the pores, most disease causing organisms cannot. A coating of colloidal silver adds a chemical process to stop other bacteria. Together, this system eliminates 98% of the harmful diseases present in surface water. It does not eliminate some chemicals.*

Result card H_2S colour code



(-) No change. If there is no colour change this indicates that the water is clean and free from bacterial contamination.

(+) Slight change, the Paper strip or water sample has turned grey. If the water has turned grey, there is a possibility that bacteria, is present in the water.

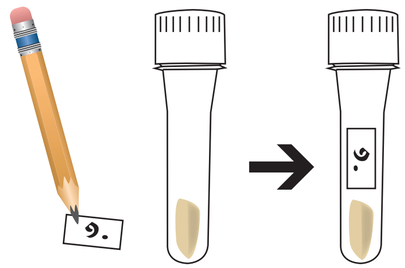
(++) The Paper strip or water sample is partially black. If the colour change is partially black then there is some bacterial contamination in the drinking water. You may want to set up a regular monitoring program and filter or boil your drinking water!

(+++) The Paper strip and the water sample are noticeably black. If there is a fast reaction- that is, the water solution and paper strip turns black overnight, this means there is a high probability of bacteria present. Your water is contaminated! You should clean out your water storage containers, tanks or well and boil or filter the water before you drink it!

ACTIVITY 1
Dirty hands!

ACTIVITY 2
Is my water supply safe to drink?

1.



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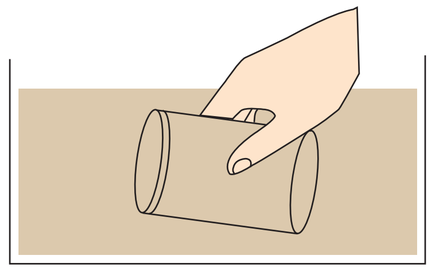

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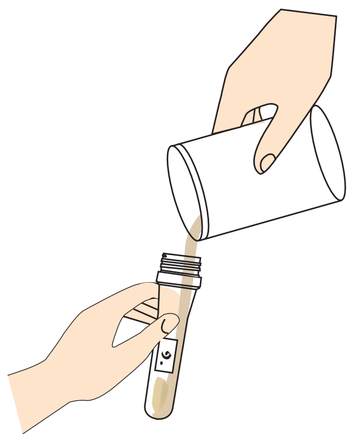

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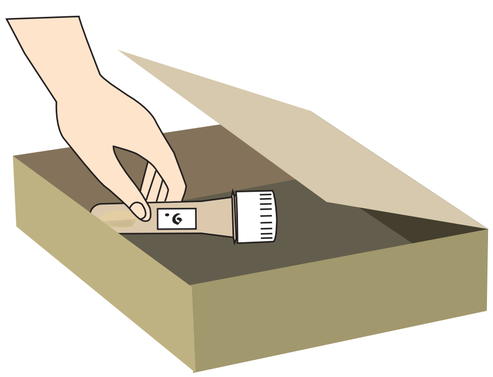
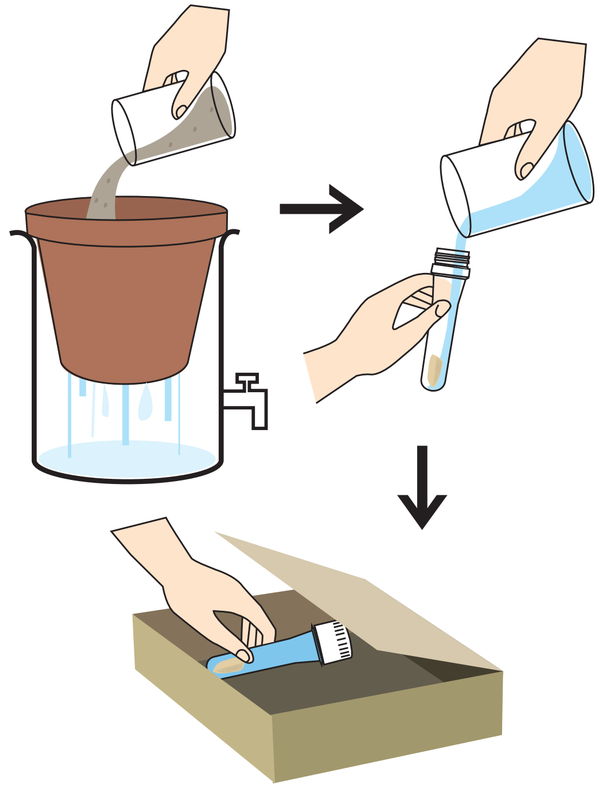


ACTIVITY 3
Ceramic Filters – purification



WATER ACTIVITIES: A TALE OF 2 RIVERS

45 minutes

ACTIVITY 1:
A tale of two rivers

Grade level: from grades 4-8

Materials: flipchart illustration, paper, pens

OBJECTIVES:

After these activities students can:

- identify the causes of water pollution
- identify the sources of water pollution
- compare advantages of healthy river and disadvantages of unhealthy river
- protect the water resources from polluted at school/community
- share their knowledge to family/ community

MAIN IDEAS:

Water pollution is caused by the activities of people who live along a river and within the rivers catchment. The catchment is any place where water will eventually drain into the river. Manure from farm animals such as pigs and cattle, human wastes, rubbish, and industrial wastes, such as oil, all contribute to pollution. Even if one person only contributes a small amount of waste, the combined impact of many people can be huge. This means that everyone is responsible for creating pollution, and everyone should take some responsibility in fixing the problem. Water pollution affects people by killing fish, and making water unsafe to drink. By making changes to the way we manage our wastes, water pollution can be reduced or prevented, which will help keep the environment and people healthy.

ACTION:

1. Show the students the picture of the two rivers, where one is badly polluted and the other is healthy. This picture is on the opposite side of the flipchart.
2. Ask the students the following questions and encourage them to share their opinions:

QUESTIONS:

a. Are the 2 pictures the same?

b. What are the causes (or sources) of pollution that you can see in the unhealthy river? Make a list on the blackboard.

c. Why do you think the man and woman in the bottom of the picture look poor and unhealthy?

d. What can you see that is similar to what happens in your own village?

e. What differences can you see between this picture and the unhealthy river?

f. What activities can you see that would reduce or prevent water pollution from happening? Make a list on the board

g. What are the people doing in the boat in the lower stretch of river? Why would they come to this river? How could they benefit the community?

h. Why do they build a fence on the river side?

i. What can you see here that is similar to your own village?

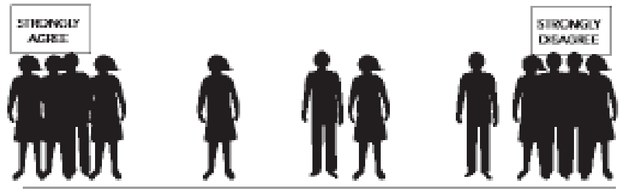
j. What good practices could you promote and introduce to your community?

k. Which of these environments would you like to live in? Why?

Who is responsible for water pollution?

1. Write down a statement on a piece of paper, an example is: "the Cambodian Government is responsible for fixing the pollution problems in our river.'
2. At one end of the room place the sign that reads 'strongly agree' and at the opposite end place the sign that says 'strongly disagree.' Draw a line between the two signs using chalk or masking tape.
3. Present students with the statement "the Cambodian Government is responsible for fixing the pollution problems in our river" and tell them that they must consider this and decide if they support it or reject it. If they strongly agree they should stand closest to the strongly agree sign, if they strongly disagree they should stand at the opposite end of the room, next to the strongly disagree sign. They can also choose to stand anywhere else on the line in-between the two extreme opinions, (e.g. agree to some extent), or in the middle (agree and disagree to the same extent). For example:
4. Ask the students to provide their reasons for why they have decided to stand on their position on the line. If the students are clustered in groups, you may give them time to discuss their reasons between themselves and then select a spokesperson. After each participant or group speaks the others should be encouraged to ask them questions.

Having considered a range of opinions, encourage the students to change their point of view (where they stand on the line and on the issue). Explain the importance and value of considering a range of ideas and being prepared to change your mind.



Reflection; discuss the following:

QUESTIONS:

a. Why did you choose to 'agree' or 'disagree'?

b. If you changed your minds, why?

c. In what ways has this discussion increased your understanding about the pollution?

d. What action could you initiate in your school or community to combat pollution issues?

Teacher's Notes: *You can repeat the 'who is responsible' activity using other statements that you develop. Here are some more examples: 'Teachers are responsible for the school environment,' 'Business and industry are responsible for waste,' 'Rubbish dumping is a more important issue than water quality.'*

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30 minutes

ACTIVITY 2:
Hand washing campaign

Grade level: 4, 5 and 6

Materials: Paper and coloured pencils or markers, soap

OBJECTIVE :

After this activity students can:

- understand the advantages of hand washing with soap
- avoid the risk of the germs and diseases from coming to the body
- spread the hand washing campaign to others in school & community
- develop thinking skills and creative skills

MAIN IDEAS:

Although people can do something about keeping the environment clean, sometimes we have to adjust to living in an environment that has pollution. Washing hands using soap is one way of reducing the risk that germs and diseases will pass from the environment into our bodies. Hand washing also helps prevent germs and disease being passed from person to person. Students can take action to help keep the school and community healthy by making other people aware of the benefits of washing hands.

ACTION:

1. Organise the students into small groups (3 or 4 students). Explain that their task is to raise the awareness of other people (in the school or community) about of the value of washing hands to prevent disease. Ask each group to think of three 'slogans' or messages that they would use to promote their message.
2. When each group has three ideas, ask them to share these with the rest of the class and write them on the blackboard. Then ask the students to vote on which ones they like the best.
3. Allow the students to return to their groups, and ask them to design a poster to promote the message or slogan that they liked the best. Encourage students to be creative, draw pictures, or cut out pictures from magazines if they are available.
4. When each group has finished their poster, display them at the school in strategic locations (e.g. where people use the toilet or eat). They could also be displayed in the community if this is appropriate.

Teacher's note: *If possible involve the students in placing soap in all the toilets and places where people eat food. Select some students as 'soap monitors' to report on when the soap needs to be replaced. You may have to seek support from the community to obtain a regular supply of soap for the children.*

"Remember, you are upstream to somebody else and somebody else is upstream to you!"

50 minutes

WASTE AND SANITATION THEORY

To identify and discuss management for types of waste and issues associated with waste.

BACKGROUND INFORMATION

Waste management is one of the biggest environmental challenges in the world. As populations grow so do waste problems. Effective waste management requires communities to take ownership of waste issues, starting from the household level. Waste can be divided into 2 major groupings: organic and non-organic.

Organic materials are often the bulk of our waste materials. Organic materials are those that break down easily in the environment such as paper, food and plant material. These organic materials can be composted.

Non-organic waste may break down, but the process can take a very long time, sometimes thousands of years. When inorganic wastes do eventually beak down, they release chemicals that can also cause pollution.

Many modern wastes are non-organic and societies are not acting to effectively reduce, reuse and recycle these wastes.

Waste can be a solid (for example bottles or cans) a liquid (e.g. sewerage) or a gas (e.g. fumes from a car).

There are 3 main sources of waste:

1. Domestic Waste - produced in the home, includes food scraps, unwanted plastic bags and bottles. Hazardous waste is produced as a result of using chemical fertilizers and pesticides.
2. Commercial waste - waste from markets, shops, hotels and health clinics. Commercial waste includes unwanted packing materials, wood, glass, plastic and food scraps.
3. Industrial Waste- produced in factories, including unwanted chemicals and other by-products generated in the manufacturing of products.

The following techniques can be used to protect people from environmental pollution caused by unmanaged waste.

REDUCE, REUSE, RECYCLE

- **Reduce** – Using less of things, for example, don't throw away paper unless you have used both sides. Reduce the use of plastics by using a longer life bag or a woven basket. For example when we buy something from a shop, which is already packaged in a box, or wrapped in paper or plastic, we do not need to put it into another plastic bag. It is even better to bring your own cloth bag and avoid plastic altogether. NB: Cambodia has a population of about 12 million people, if everyone used 4 disposable plastic bags each day, it would add up to 48 million plastic bags being thrown away everyday of the year. This a lot of plastic to waste – and a lot of money too!
- **Reuse** – There are many things that we can use again instead of throwing away, for example, use a plastic bottle again for storing honey or growing seedlings.
- **Recycle** - This is the process where recyclable materials (e.g. paper, plastic, glass, metal, aluminum, steel etc.) are converted into new products.

THE BEST SOLUTION IS TO AVOID USING PLASTIC PRODUCTS IN THE FIRST PLACE

Use a cloth bag and refuse to accept plastic bags at the market or shop. Use a water filter to refill bottles instead of opening a new bottle. And never throw waste into a street or river or anywhere else in the environment.

POLLUTION

Pollution is contamination of the environment caused by waste people produce. If people do not dispose of their waste correctly if can have serious impacts on the environment and the health of people. If people throw their waste into the river, the water will become polluted, and if people drink water or eat the fish from a polluted river they may become sick. Waste disposed of into the street will encourage rats, flies and other pests, which can also will spread disease.

IS IT SAFE TO BURN PLASTIC WASTE?

Unfortunately it is not safe to burn plastic wastes, such as plastic bags, wrappers or drink bottles. When burned plastics release toxic chemicals that are harmful to our health. Many plastics, particularly PVC (polyvinylchloride) produce deadly poisons named dioxin and furans when they are burned, which can accumulate (build up) in body fat. Because body fat is used for feeding babies during pregnancy, breast-feeding, babies are particularly at risk of absorbing these chemicals from their mothers. If you or your family burns waste, make sure there is no plastic in it.

BURYING WASTE - LANDFILL

A landfill, also known as a dump, is a site for the disposal of waste materials by burial and is the oldest form of waste treatment. Today, landfills remain the most common method of organized waste disposal in the world, but with much of Cambodia being seasonally flooded this is not so simple.

Landfills may include internal waste disposal sites (where a producer of waste carries out their own waste disposal at the place of production) as well as sites used by many producers. Many landfills are also used for other waste management purposes, such as the temporary storage, consolidation and transfer, or processing of waste material (sorting, treatment, or recycling).

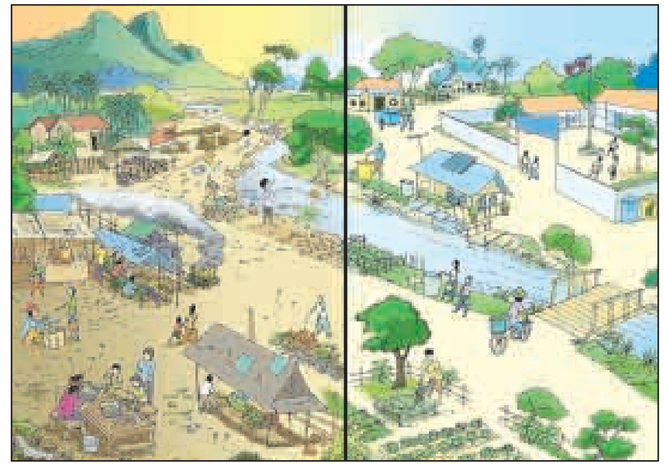
A landfill also may refer to ground that has been filled in with soil and rocks instead of waste materials, so that it can be used for a specific purpose, such as for building houses. Unless they are stabilized, these areas may experience severe shaking or liquefaction of the ground in a large earthquake.

COMPOSTING

Usually around 60 -70% of all domestic waste produced is organic (made of plant or animal material). This waste shouldn't be thrown away because they can be used to improve the soil for gardens and crops. Compost is one of nature's best mulches and soil fertilisers. Best of all, compost is free.

HOW DOES COMPOST DECOMPOSE / BREAKDOWN?

Compost is the end product of a complex feeding pattern involving hundreds of different organisms, including bacteria, fungi, worms, and insects. What remains after these organisms break down organic materials is a rich, earthy substance. Composting replicates nature's natural system of breaking down materials on the forest floor. In every forest, grassland, jungle, and garden, plants die, fall to the ground, and decay. The small organisms living in the soil slowly dismantle these. Eventually these plant parts disappear into the brown crumbly forest floor.



DISCUSSION POINTS

A. What does this picture show?

B. What types of waste can you see in the picture?

C. What is the difference between organic and non organic waste?

D. What happens if we throw non organic waste in the water and on the land?

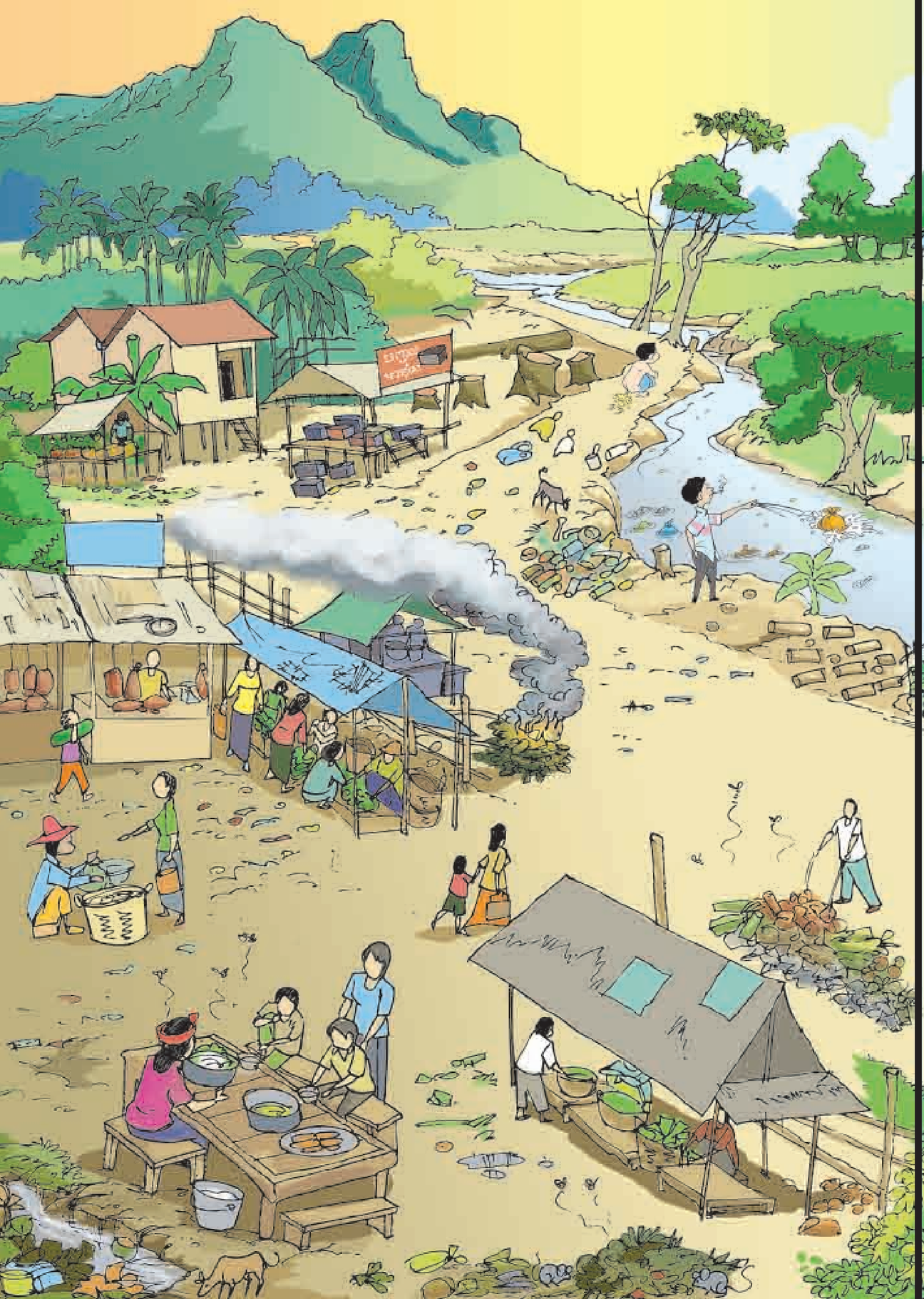
E. Does plastic decompose?

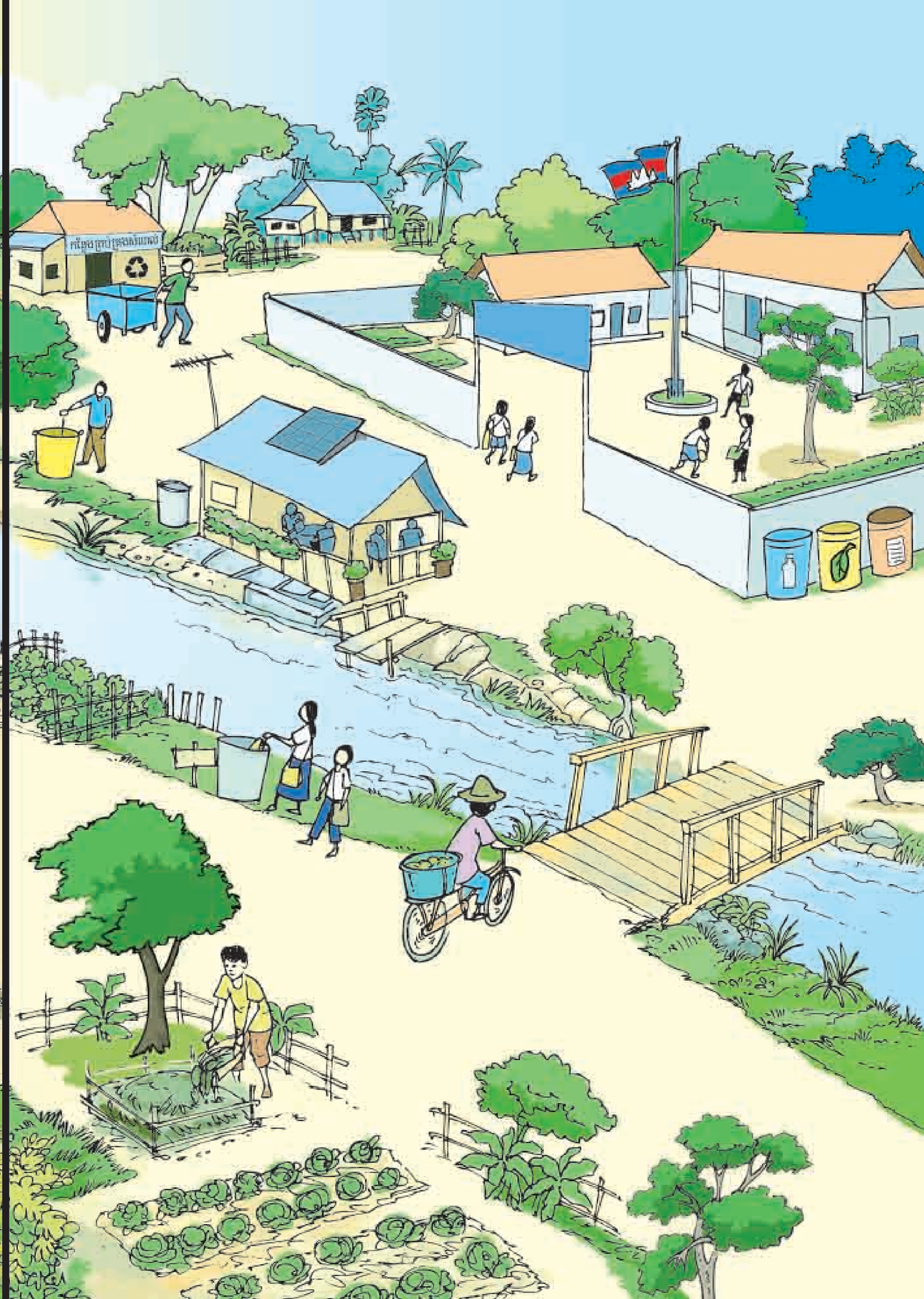
F. What happens if we throw non organic waste in waterways and on the ground?

G. Which would you expect to break down the quickest, a banana, a plastic bag, or some paper? Why? How can waste affect human health?

H. What happens when we burn a plastic bag?

I. How can you manage or reduce plastic waste in your community?





WASTE ACTIVITIES: AROUND YOUR SCHOOL

30 minutes

ACTIVITY 1
School Audit

Grade level: from grade 4-8

Material: Large white paper and coloured markers. Question sheets and four rubbish baskets

OBJECTIVES:

After this activity students can:

- manage the waste around their school
- identify the different kinds of waste around their school
- identify the sources of the waste laying in school
- develop recording and analyzing skills
- take responsibility in keeping the environment around their school clean
- identify the reduce reuse and recycle waste

MAIN IDEAS:

It is very important keep environment clean in the school compound. Teachers and students have to manage the waste around school. Clean environment is very important to attract either teachers or students to come to school. Because environment is our lives. Everyone prefer to live with healthy lives. Clean environment makes our lives healthy and unclean environment causes bad lives.

ACTION:

1. Split the students into 4 groups and give each group a School Audit Handout.
2. Students should walk around the school ground in groups and record and collect the different kinds of litter (rubbish) they find. Record the rubbish listing it on the handout.
3. Students should answer the following questions on the handout:
   a. Record the numbers of each kind of rubbish. What is the most common?
   b. Where does this waste come from? How did it get here?
   c. What are problems caused by having rubbish in the schoolyard?
   d. Identify any of the rubbish that can be reduced, reused or recycled. Write the names of the rubbish in each column.
   e. Who should be responsible for keeping the school clean?
   f. What actions can you and your school take to ensure the school is kept clean?

Teacher's note: *It is necessary to first understand what waste is being produced so that you can develop a suitable waste management plan. If you don't know what waste there is how will you know how to manage it? Do they have management problems? What about recycling programs already? This exercise can also be used in other parts of the community.*

30 minutes then ongoing

ACTIVITY 2
Waste Decomposition

Grade level: from grade 4-8

Material: 4 plastic containers, (can use water drinking bottles cut in half) 4 different waste materials (plastic, paper, fruit waste, peel, skins, vegetables, leaves, etc.)

OBJECTIVES:

After this activity students can:

- identify the organic matter and non organic materials laying in their school.
- identify the time of the waste decomposition in different kinds of the waste.
- reduce using non organic matter (plastic...)
- decide which of the waste could be made compose.
- develop observation skill and thinking skill.

MAIN IDEAS:

To know the waste decomposition and it's duration is a very important way to consider which waste should be used for making compose which one should be reduced, reused and recycled.

ACTION:

1. Take a few different waste materials and place one in each container.
2. Leave them in the containers and check them each week. Are some things changing? Which are changing and which are not? Estimate how long it takes for different kinds of rubbish to break down (note, this will vary Depending on weather conditions)

Teacher's note: *Different materials break down at different rates – some organics (matter derived from living things) can break down very quickly while things like plastic may not break down. With organic materials some have high nitrogen and break down quickly while others have higher carbon and break down slowly.*

25 minutes

ACTIVITY 3:
Reuse waste

Materials: plastic containers, soil, seeds

If you are creative, there are many ways to reuse materials that might otherwise be thrown away as waste. The following provides one example, however you may be able to think of many more ideas to practice with your students.

Growing plants in plastic bottles

It is better to reuse old plastic containers than buy special new containers to grow plants. By reusing a plastic container, you are effectively reducing the amount of waste that needs to be disposed of. By growing a plant you are also having a positive impact on the environment.

1. Encourage the students to keep or collect a number of plastic containers such as drinking water bottles.
2. Cut the tops off the plastic containers and put small holes in the bottom for drainage.
3. Place a piece of paper in the bottom of the container and then fill it with soil. The container is now suitable for planting the seed (note bigger plants need bigger containers). Make sure you keep the soil moist but give it some but not too much sunlight. Take care of the seed and it should grow.

30 minutes

ACTIVITY 4:
Recycling at your school

Materials: Bins or containers to hold recyclable materials, water and soap to wash hands after collection

Many different types of waste materials can be collected and processed into new products. Recycling means that materials that would have become waste have a new life, and it also saves resources by reducing the need for manufacturers to find new raw materials. Melting down one tonne of recycled steel cans uses only one quarter (or 25%) of the energy needed to make new steel! Depending on where you live in there are probably some products that are recyclable. Examples are aluminium cans, scrap metal, car and motorcycle batteries, paper and plastic bottles (PET).

Firstly you need to find out what can be recycled in your area. A good way to find out is to talk to someone in the community who already collects recyclables.

Establish sorting containers at your school to collect only those materials that can be recycled. The collecting containers could be cardboard boxes, bags or plastic containers.

1. Divide the class into 4 groups and give each group a bin.
2. Involve the students in labelling the bins according to what students can place in them, ie. 1. paper, 2. compost, 3. Metals, 4. plastics.
3. Send students outside for 10 minutes to collect relevant materials for their bin.
4. When they return get them to wash their hands with soap and sit down.
5. Hold up each bin, and ask each group in turn, the following questions:

QUESTIONS:

   a. Have you collected a lot?
   b. what kind of waste have you collected?
   c. What could we do with this?
   d. Can we sell it?
   e. Can we compost it?
   f. Can we reduce our use?


លោហធាតុ
ក្រដាស
សំណល់រលួយ
សំណល់
ប្លាស្ទិក

WASTE ACTIVITIES: TAKING ACTION ON WASTE

Grade level: from grade 4-8

OBJECTIVES:

After this activity students can:

- interest in keeping environment clean
- identify the different types of the waste (organic and non organic matter) and its advantages and disadvantages
- prepare the compost at their school/house
- write the suggestion to relevant authority/ organization relates to the waste.

MAIN IDEAS:

Taking practical action is an important step in overcoming environmental problems. After problems have been identified we must consider what can be done to solve them. Learning about a problem is not enough to make it change. This activity challenges students to think about what they can personally do in response to waste issues. Students will plan and practice hands-on waste management action and learn a range of waste management techniques.

---

80 minutes

ACTIVITY 1:
Reduce waste - make a bag!

Materials: Scissors, cloth,-sewing needles & thread, markers or paint to write on bag

Plastic bags are a big part of the waste problem. Plastic bags take hundreds of years to break down, they can choke and harm wildlife and form breeding places for disease carrying mosquitos. Fortunately we can reduce the amount of plastic bags that are used when we go shopping by saying 'no!' to plastic bags through the following simple actions:

- Take old plastic bags shopping so you can use them again
- Use a cardboard box or other container
- Carry as much as you can without a bag (do you really need a bag for that 1 item?)
- Buying a bag that you can reuse
- Making a reusable bag

ACTION:

1. Break up the class into 4-5 groups and give each group some fabric, scissors, needle, thread and coloured markers
2. Show the class the bag making instruction, as on the flipchart page.
3. After they have completed the bags, they can present them to the class
4. Ask the students: 'Why do we need to make this bag?'

60 minutes

ACTIVITY 2:
Option a: composting on Land

Materials: Composting handout, large knife, water, organic materials for composting (e.g. fruit, vegetable scraps, leaves, grass, paper, cardboard etc).

Compost reduces what is considered waste by changing organic material into useful, fertile soil without the need for any chemicals. Compost is nature's way of breaking down organic material into usable pieces for plants and animals.

1. Discuss the concept of compost with the students.
2. Get them to list down the organic materials that are considered waste.
3. Ask students to collect organic materials from the school or home that can be used for composting.
4. Layout the materials that have been collected for the heap and ensure that there are also sufficient leaves or dry yard wastes. Examine the material and determine which should and should not be placed in the heap. For more detail, follow the instructions on the ***composting handout***.
5. When the compost has matured (turned into soil) is can be used to grow plants, such as healthy vegetables

Option b: Liquid Compost (for floating communities)

Grade Level: 4 up

Time: 40 minutes

Materials: knife, basket, a bag, a few big rocks, bucket or water jar, organic waste, different plants (green and dry) and so on

OBJECTIVES:

At the end of this activity the students will be able:

- To describe about how to make liquid compost
- To explain the importance of liquid compost and its use
- To make liquid compost by themselves at their school or their home

MAIN IDEAS:

Liquid compost is a natural fertilizer that was produced for using. Making liquid compost is a way to reduce some waste and can produce a fertilizer that is useful for crops or seedlings watering to grow well. It also helps to reduce the chemical use that affects to our health and soil quality. Liquid compost can produce from organic waste and different kinds of poisoning plants that can be available in the community and it can provide as fertilizer and natural pesticide to protect pest.

ACTION:

1. Firstly prepare materials, organic waste and different kind of plants
2. Put organic waste and different kind of plants including a few big rocks into the bag and tie up.
3. Then immerse bag into the bucket or water jar and cover it with water. Then put the lid on the bucket.
4. Keep it around one month or when there is no bad smell, then it can be used for the crops
5. Explain to student that the compost mixture needs to be diluted one part solution to 3 parts water as it is strong and can burn plants.

60 minutes

ACTIVITY: 3
Waste campaign: Advocacy

Materials: pen and paper.

If your students feel that there are some important changes to make in your community that will improve the way that wastes are managed, then you may want to convince the public or decision makers to consider your ideas. Sometimes we get frustrated with authority because we don't think they are giving priority to an issue that we feel is very important. When we try to influence the regulations or laws of our governments or we try to convince a local industry to improve its waste management practices then this is called advocacy. We are advocating for change.

Advocacy is the act of publicly recommending a course of action or being actively supportive of a cause. It is done when people are not satisfied with the status of something in their community or country.

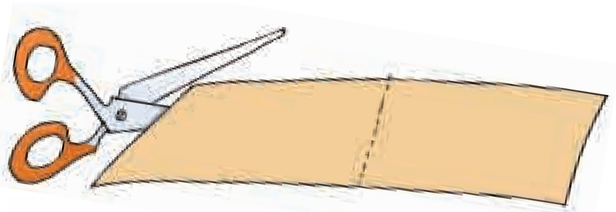
These are some of the ways the students can advocate for change in waste management:

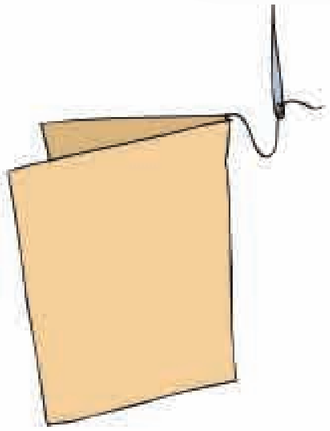
- **Talk to people.** Arrange for students to meet with people in positions of authority who have some kind of influence in decision-making. Students should be encouraged to respectfully convey their ideas and suggestions about how waste can be managed better and how these changes will benefit the community.
- **Public Awareness Campaign.** The more people that are aware of and understand waste issues, the more support you will have. The media is an effective tool for raising public awareness. Students can write articles for your local newspaper and use the radio or television for announcements or interviews. Other ways that students can get messages to the public is through pamphlets, posters, workshops, special events, a song or a play.
- **Political.** Encourage students to write letters to politicians who have been elected in your local area. Cambodia is a democracy, so the people who have been elected have a responsibility to serve you and the community. Students should explain why waste is a problem and ask the politicians to take some action to improve their situation.

Teacher's notes: *Students should be involved in all stages of taking action, starting with finding out about the waste problem, looking at options for taking action, deciding which option to take, and getting hands-on in the taking the action. As the teacher, be careful not to do everything for the students. The students' involvement will teach them that they have a responsibility and the capacity to take action that may lead to a more positive future. Involvement in actions is very empowering, it can also assist to develop positive attitudes, behaviours and motivate students to 'learn by doing.'*

If you undertake advocacy, it will be a good idea to ensure that the issues are not too sensitive to raise with politicians. It is a good idea to let the politicians know what you are doing, and that they can expect letters from the students. This way you might be more likely to receive a positive response.

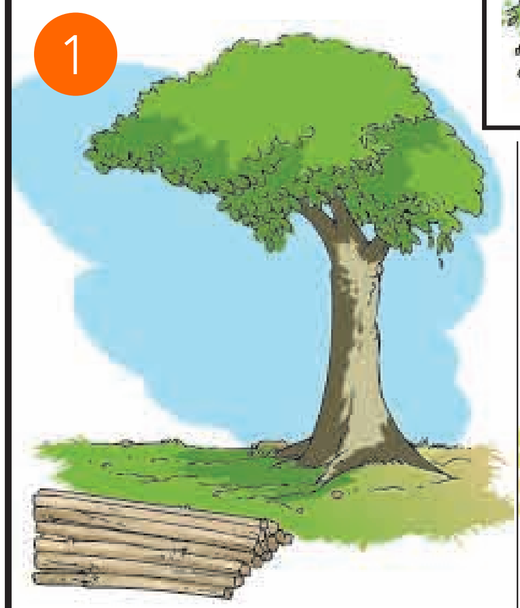
ACTIVITY 1
Reduce waste, make a bag

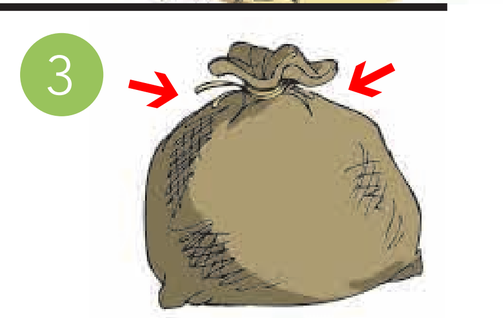


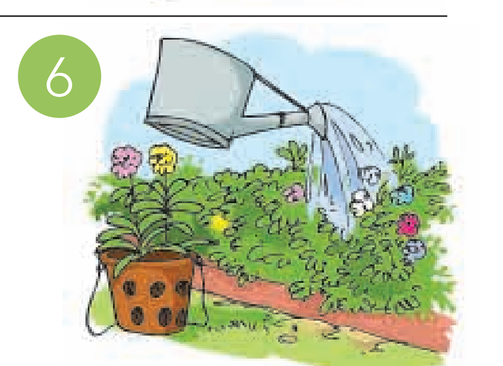


ACTIVITY 3
Waste campaign: Advocacy

ACTIVITY 2 - Composting







XX minutes

ENERGY THEORY

Objective: To understand renewable and non-renewable sources of energy and why efficiency is important.

BACKGROUND INFORMATION

What is Energy and why is it important? It's simple – energy is the ability to do work.

The Sun is the most significant energy source on earth. Energy from the sun gives us light and heat during the day. The Sun provides the energy that allows plants to grow, and this energy is transferred to animals (including people) when the plants are eaten.

Why do humans need energy? When we eat, our bodies transform the energy stored in the food into energy to do work. When we run or walk, we "burn" food energy in our bodies. When we think or read or write, we are also doing work. Many times it's really hard work!

Why do plants and animals need energy? The energy is used for plants and animals to grow. Energy stored in plants is eaten by animals, giving them energy. And predator animals eat their prey, which gives the predator animal energy.

SOURCES OF ENERGY

There are many different types of energy, but they can be divided into 2 sources: some are 'renewable,' that is can be easily made or renewed, others that cannot are called non-renewable. So long as they are used wisely, sources of renewable energy should never run out. Examples of renewable energy are: solar, wind, geothermal (energy contained within the Earth), biomass (energy from plant and animal matter), and hydro (energy generated by running water).

Nonrenewable fuels are those that cannot be easily made and gradually run out as they are used up. These fuels can only be used until the supply runs out. Oil, natural gas, uranium (nuclear) and coal are examples of nonrenewable fuels. Non-renewable fuels power most of the world's cities and transport systems, such as boats, trucks, cars and motorbikes.

SOURCES OF ENERGY IN CAMBODIA

Generally in Cambodia the electricity is generated using non renewable energy. However in many rural areas many households do not have electricity. However energy and fuel is still very important in these households and is used in a variety of ways. For example, in the Tonle Sap a typical family uses : wood(flooded forest) for cooking and boiling water , kerosene for lighting, petrol for transportation...

SUN – Plant Power (Photosynthesis)

Most plants don't have to graze, hunt, or shop for food. No, they just wait and create meals out of sunlight and water. Sunlight is actually energy, electromagnetic energy to be exact. When that energy gets to a green plant, all sorts of reactions can take place to store energy in the form of sugar molecules.The process that allows plants to take energy from the Sun and create sugars is called photsynthesis. Not all plants go through the process of photosynthesis, but most do and it is considered the base of the food chain.

Plants are able to turn sunlight into energy but not directly. Plants are actually able to store energy in some chemical bonds that can be used later. There are two processes: Photosynthesis and Respiration. Photosynthesis stores the energy and Respiration releases that energy. It all starts with energy from the Sun, and this energy can be used for other things; when we hang clothes outside to dry in the sun, we are using the sun's heat to do work -- drying our clothes.

SOLAR POWER

Solar energy can also be converted directly or indirectly into other forms of energy, such as heat and electricity. Solar energy is used for heating water for domestic use, space heating of buildings, drying agricultural products, and generating electrical energy. The major drawbacks (problems, or issues to overcome) of solar energy are: (1) the intermittent and variable manner in which it arrives at the earth's surface and, (2) the large area required to collect it at a useful rate.

ENERGY EFFICIENT COOKING STOVE

Firewood is wood used to obtain energy for people to use. The most common use of firewood in Cambodia is used for cooking.

In Cambodia, wood fuel may be available as firewood, charcoal, chips and sawdust.

In rural areas many people harvest the wood from the environment around their communities, and in cities such as Phnom Penh, people buy wood and charcoal from the market.

Communities around the Tonle Sap harvest wood from the flooded forest for fuel for cooking. Wood is a renewable fuel, because trees are able to re-grow. However, if too many trees are cut down, and new trees do not replace them, the forest quickly disappears and so does the future supply of wood. This has happened in the Tonle Sap, where forests have been cleared and not replaced. The impacts of clearing flooded forest includes destroying the habitats of fish, fresh water snakes, turtles and other valuable animals. The loss of forest is especially bad for the fish that need the forest to breed during the flooding season.

REDUCING THE USE OF FUEL WOOD TO PROTECT OUR FORESTS & LIVELIHOODS

Unfortunately the demand on wood for cooking and building has seen a reduction in Cambodia's forests. The forests can be protected by using the wood more efficiently (using less), finding alternative sources of energy that don't use wood, and allowing the forest to re-grow where it has been cut. This may include planting trees, or just allowing the forest to grow back naturally.

If we can use wood more efficiently for cooking, we may be able to save money, time and even some valuable forest.

The reasons for using the Efficient Cooking Stove include: it is economical if we compare with traditional stove, for example: time, fuel or coal and money efficiency, burns well and stores the heat longer, well insulated and so heat does not escape to make cooking hot and unpleasant, can burn other debris and not just wood cur from trees, creates less smoke and carbon dioxide (CO^2) and it helps to conserve the forest by gaining the same energy and benefit from less wood

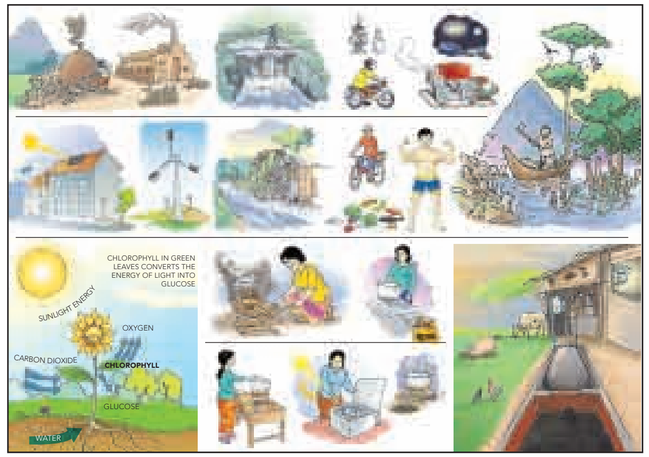
In Cambodia some people use the cuttings from the rubber plantations or sustainably cut and thinned trees as a more sustainable for of wood fuel. The combination of more efficient use of the wood fuel and more sustainable collection is very important

BIOGAS ENERGY

Biogas is a mixture of carbon dioxide and methane gases that are produced by microorganisms that live in places without a supply of oxygen. Animals that eat plants, for example pigs, cattle and water buffalo, have microorganisms living in their stomachs and produce large amounts of biogas.They release this biogas when the burp or fart! Biogas is also produced by microorganisms that break down the organic matter that builds up in the bottom of swamps and lakes such as the Tonle Sap.

Biogas is useful to people because it can be burned as a fuel to cook food, boil water or even provide light.

Biogas must first be collected or harvested. People can do this by building an airtight storage tank called a 'digester,' and filling it with waste products such as animal manure or human waste. When bacteria break down the waste in the digester they produce biogas, which can be collected and stored under pressure. It can then be fed through pipes to gas cookers or gaslights in our homes or community. Biogas is considered to be a renewable source of energy. This is because the production of biogas depends on the supply of grass, (used to feed than animals which create manure) which usually grows back each year.



DISCUSSION POINTS

A. What does this picture show?

B. Where does energy come from?

C. Can you give an example of energy?

D. What energy do you use at home?

E. Where do you get energy for cooking in your home?

F. What types of energy are renewable and non renewable?

G. How could you reduce your energy use at home? (efficiency)

H. Why is biogas considered a source of renewable energy?

I. Why is reducing use of firewood important for our livelihoods?

CHLOROPHYLL IN GREEN LEAVES CONVERTS THE ENERGY OF LIGHT INTO GLUCOSE

SUNLIGHT ENERGY

OXYGEN

CARBON DIOXIDE

CHLOROPHYLL

GLUCOSE

WATER

ENERGY ACTIVITIES: SURVEYS

Grade level: from grade 4-8

Time: Ongoing

LEARNING OBJECTIVES:

After this activities students can:

- Observe/conduct survey on energy uses in their houses/community
- Identify the renewable energy and non-renewable energy
- Reduce using non-renewable energy by using renewable energy instead

MAIN IDEAS:

These activities give the students an opportunity to research the energy use in their houses/community by conducting survey. They can understand the benefits of using renewable energy and reducing the non-renewable energy and also reducing wood energy especially the flooded forest that is a big problem for the communities around Tonle Sap. Because the flooded forest is habitat for water animals, water birds especially the fish during the flooded season that they can breed their small babies.

450minutes

ACTIVITY 1:
Finding out about energy use

Students can do this activity individually or in small groups. If you choose to organise the students into small groups, each group will need to be made up of students who live near each other.

1. Explain to the students that they will conduct an energy survey about energy use in their homes and community. The survey will record the various activities that require energy, and how energy is supplied for these activities.

   The energy survey can be conducted in one day or evening. The students will need to explore their homes and take note of all the activities or items that use energy. Students may record energy uses that are not happening at the time of the survey, but are known to happen. For example a TV might not be used on the night of the survey, but used at other times and may be recorded in the survey.

2. Give the students a copy of the energy survey sheet. e.g.

Household activity or item that uses energy	Source of energy
E.g. *Cooking*	*Wood*

3. Give some examples of energy use and supply that students might expect to find. Activities or items that use energy could include lights, radio, cooking, boiling water and motorbike. Source of energy used could include wood (burning), charcoal, natural gas, biogas, petrol and batteries.

4. Set the task of completing the survey as homework for the students. If you have chosen to allow students to work in small groups, they will need to agree on a time to visit each other's homes. Make sure that all students write down their names, location of the house and date on their survey.

   They will use these results in the next activity.

---

45 minutes

ACTIVITY 2:
Drawing conclusions about energy use

After students have completed the survey the class can collate the results from individual households to look for the broad patterns of energy use that occur in their community.

1. Use the A2 chart provided, if you don't have a copy, draw it on the blackboard, similar to the example below.
2. Ask students to read out results from their surveys and make a vertical column with the various ways energy was used under column 1.
3. Then add to the right, more columns that represent the various sources of energy. e.g. wood, coal, gas, kerosene etc. (You may have more columns than shown on the example below.)
4. Then ask students to raise their hands if they have made the same observation.

Reflections and discussions

Ask students to answer the following questions

QUESTIONS:

a. What differences can you see from this table?

b. Can someone come and tick the sources that are renewable and those that are non-renewable?

EXAMPLE OF ENERGY USE TABLE

1. Household activity or item that uses energy	wood	coal	Natural gas (bottled)	Petrol	Kerosene	electricity	generator	batteries	solar power	etc.		
e.g. Boiling water	*eg. 15*											
Cooking												
Lamp												
Torch												
Total												

ENERGY ACTIVITIES: ALTERNATIVE ENERGY USE

Grade level: from grade 4-8

Materials: 2 Magnet torches and 2 Gyro torches and Solar panel kit Solar panel kit Biogas digester (provided), water, animal manure such as pig, cow, chicken…… plant leaves, grass, food waste etc.

OBJECTIVES:

After this activity students can:

- Develop their thinking skills
- Identify the advantages of using magnet torch
- Decide which torch should be used or which torch should not be used
- Share this information to their family/community
- Identify the advantages of the sun energy
- Try to use the sun energy as much as possible in order to reduce using non-renewable energy

MAIN IDEAS:

These activities promote students to use renewable energy as much as possible: the solar energy (sun energy) magnet energy (magnet torch) biogas... and try to reduce using non-renewable energy. Especially people living around Tonle Sap try not to use battery torch by using magnet torch instead to avoid throwing battery into Tonle Sap when the energy runs off. They should use biogas energy that produced from their daily waste or use solar energy to avoid cutting the flooded forest that is the fish habitat during the flood season.

30 minutes

ACTIVITY 1
Alternative energy torch

Materials: 2 Magnet torches and 2 Gyro torches

ACTION:

1. Ask the students to describe how a torch works.
2. Ask them what powers the torch? If they say batteries ask what powers the batteries?
3. Then get the students to break into two groups. Give each group a magnetic torch and a gyro torch.
4. Ask them to explain how these work if they do not use/need normal batteries.

Teacher note: Everything is made of molecules. Every molecule consists of small particles called atom. In the middle point of each atom consists of noyau which has proton (+) and neutron. Noyau is surrounded by small moving, negatively charged particles, called electrons (-). An electrical field surrounds every particle that has an electrical charge. By convention, the lines of the electric field are said to radiate from a (+) particle and move towards a (-) particle. It is not certain if there is any direction of radiation, and there is no real good explanation of what the electric field is made of. It's just there. In this case the magnet moves past the field to make electrons. The electrons which, move in a current (through the wire) make electricity. The electricity then powers the torch.

30 minutes

ACTIVITY 2
Magnifying glass & solar energy

Materials: magnifying glass 75cm and a piece of wood or paper

Goal: to show the power of the sun and that solar energy can be harnessed

OBJECTIVE:

- Use magnifying glass to combine the solar energy over one thing
- to discuss the effect of the solar energy combination
- discuss the possibilities of solar energy

METHOD:

- Choose a sunny day
- The teacher should take the magnifying glass and a piece of paper or small block of wood.
- Instruct the children to go outside with you
- Find the sun in the magnifying glass and capture the rays of the sun and project this onto the wood or paper
- If you have done this correctly, the wood or paper will start to smoke

Note : please tell the children to be careful when experimenting with magnifying glass as it can be dangerous.

30 minutes then ongoing

ACTIVITY 3
Turning home waste into biogas

Materials: Biogas digester (provided), water, animal manure such as pig, cow, chicken…… plant leaves, grass, food waste…….

ACTION:

Put the animal manure, plant leaves, grass, food waste…and water in to the bio digester by following the process below:

1. Cut the bottom off a 4L plastic milk jug to make a wide-mouthed funnel.
2. Place the funnel into the neck of the plastic water bottle and scoop in small amounts of manure.
3. Use a stick or piece of dowelling to push the manure through the neck of the bottle if it gets plugged.
4. Add enough water to bring the level close to the top of the water bottle.
5. Store the biogas digester somewhere safe, where no one can tamper with it. After 2 weeks, gas will begin to accumulate in the balloon. You can check to see if this gas is methane and will burn, by attempting to light the Bunsen burner:
6. Choose 2 students to conduct this test. One student can open the clamp or valve so that biogas can flow back from the balloon to the Bunsen burner. Another student can squeeze the Mylar balloon gently while you (the teacher) attempts to light the Bunsen burner with a match or spark igniters.
7. If your Bunsen burner ignites, your biogas is success!
8. Once the experiment is complete, ask the students the following questions.

QUESTIONS:

a. What could we use this gas for?
b. Could you use this in your home?
c. Can you describe how to make biogas?

Teacher note: For the first few weeks, your biogas generator will produce mainly carbon dioxide. When the aerobic bacteria use up all the oxygen inside the bottle, the anaerobic bacteria, which make methane, can take over. It can take up to a mouth for the generator to start making biogas with enough methane to be flammable.

Warning : please tell the children to be careful when experimenting with biogas as it can be dangerous. The gas is invisible, and therefore, it can be dangerous when igniting this. They should hold the hose away from their face. Hold it as far away as possible.

ACTIVITY 1: ALTERNATIVE ENERGY TORCHES

Inside the torch, 2 magnets pass over each other

ACTIVITY 2: MAGNIFYING GLASS AND SOLAR ENERGY

ACTIVITY 3: TURNING HOME WASTE INTO BIOGAS

XX minutes

CONSERVATION OF BIODIVERSITY THEORY

To better understand the importance of biodiversity by identifying types of biodiversity, diversity of forests and fish and the key threats.

BACKGROUND INFORMATION

WHAT IS BIODIVERSITY?

Biodiversity is every living thing, including humans. The importance of biodiversity should not be underestimated, as it provides food and other basic needs for our lives and helps the balanced functioning of many natural systems – even the air we breathe. Natural resources are biodiversity that people use. In Cambodia 4 out of 5 people depend on natural resources for their livelihood. A large proportion of the population in Cambodia lives in wetland areas and their well-being depends on the productivity of wetlands.

Within the environment, living things interact in many ways, for example, in the case of feeding relationships or as it is often called a 'food chain'. A food chain is made up of living things that are linked together by what they eat. Example: plant - small snail eats plant - fish eats snail - human eats fish.

TYPES OF BIODIVERSITY:

Biodiversity has three components: genetic diversity, species diversity and ecosystem diversity. These are explained in the following sections.

1. Genetic Diversity: Genes control the inherited characteristics of an organism. Example: Rice from different areas in Cambodia has developed different characteristics according to the environment it grows in. The existence of over 2000 varieties of rice in Cambodia is an excellent example of genetic diversity or the variation between different populations of the same species (rice).
2. Species Diversity: A group of organisms that can breed to produce fertile offspring. Counting the number of species occurring in a particular area gives us the species richness. There are around 200 species of fish, 42 species of reptiles, 225 species of birds and 46 species of mammals in the Tonle Sap – this is a species rich area.
3. Ecosystem Diversity: Communities of interacting organisms and the physical environment in which they live. Such as: agro-ecosystems, forest ecosystems, grassland ecosystems, freshwater ecosystems and coastal ecosystems. The rice ecosystem is the links between the soil organisms, insects, rice and other plants and animals all found in the rice fields.

DIVERSITY OF PLANTS

There are many kinds of forests in Kingdom of Cambodia, which have covered around 50 % of total whole land. 6 kinds of the important forests:

1. Green Forests: These forests are always green each year.
2. Leaf-dropping Forests: The forests which drops its leaves, mostly in dry season.
3. Mangroves Forests: The forests which are growing in coastal zone.
4. Flooded forests: Surrounding of Tonle Sap areas, it is plentiful of flooded forests.
5. Bamboo forests: The forests which are not much plentiful in Cambodia and it could be seen where the forest trees cut, and then the bamboo start grow instead.
6. Pine forests: The forests are not too much in Cambodia, it could be seen in Kirirom (Kompong Speu Province), and other areas in Mondulkiri and also in Kompong Thom province.

PROTECTED AREAS

Most scientists believe that the best way to prevent the loss of wild species is to establish and maintain a system of reserves, parks, wildlife sanctuaries and other protected areas. In 1925 Cambodia became the first country in Southeast Asia to establish a national park, when the 10,800 ha forest around the Angkor Temple complex was declared a protected area.

In November 1993, His Majesty King Norodom Sihanouk issued a Royal Decree (or Kret) designating 23 protected areas, covering about 3.3 million ha (18.23% of total land area), and including seven national parks, ten wildlife sanctuaries, three protected landscapes, and three multiple use areas (all referred to as Protected Areas). Even if a high percentage of Cambodia's land area already falls under designated protected areas, there is still a need complete the network and to protect and manage them.

DIVERSITY OF FISH & ANNUAL CATCH

The floodplains of Cambodia are one of the most productive freshwater fishery zones in the world because of high biodiversity, accessible floodplains, and high fishing rate.

There are around 500 freshwater fish species in Cambodia. Between 1940 and 1995 the fish catch increased twofold but the population increased threefold, so the catch has declined from 347 to 192 kg per fisher per year over 55 years. Fishing and fishing related activities represent more than one third of Tonle Sap People primary occupation and half of their secondary occupation. About 88% of inhabitants rely on fish resources for their livelihood. Around the Tonle Sap Great Lake, the total fish consumption per person per year is 75.6 kg. Other animals' consumption per person per year is 8 kg. There are 1.1 millions living around the Great Lake, in 1158 villages.

Although not as prolific Cambodia's coastal zone, with rivers, mangroves, sea grass, corals and islands provides a rich marine fishery.

THREATS AND CHANGES

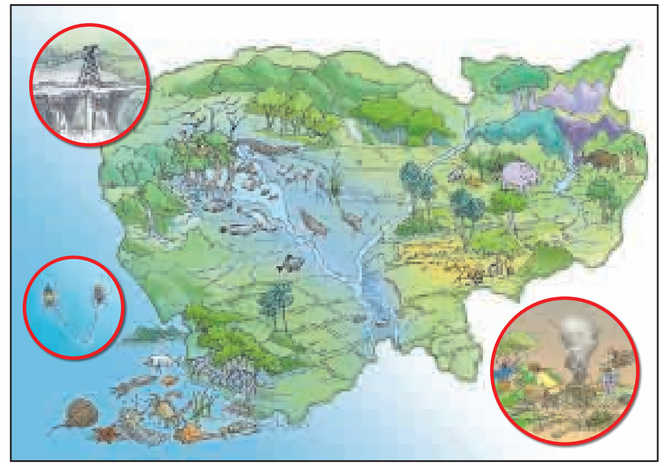
THREATS: The most important threats are hunting and habitat degradation or loss. Loss of access to key feeding areas due to habitat fragmentation reduces the number of animals that can live in any particular area and forces animals into other parts of the forest where people may also live. Human settlements in the areas where animals live threaten remaining populations. Reduction in access to food also threatens these animals survival. For example, the drastic reduction in the number of deer and wild cattle which are a primary source of food for tigers, means that some of their food sources are no longer available to them.

Populations of turtles are much reduced in areas with moderate to high levels of human use. The main threats to turtles are hunting for subsistence use and to meet international and national trade demand for food and traditional medicine. Animals are traded for food, for trophies and medicine. Many horned animals are killed for their horns, while bears are prized for their gall bladder.

If hunting of threatened or rare species continues it is very likely that these species will follow the way of the rhinoceros and become extinct in Cambodia.

Hunting and trafficking are major threats to wildlife.

Illegal fishing gear comprises fishing gear, equipment and practices which are indiscriminate and destructive to both the fisheries resources and the environment. Illegal fishing gear, equipment and practices include: electro-fishing gear, chemicals, explosives, water pumping, three-pronged barb-less spear with magnifying glass, case net less than 1.5cm, mosquito nets and encircling seine net with light or fire, and so on. These illegal fishing practices are often very effective for catching fish, but their impact on the fisheries and environment is destructive and unsustainable. Cambodia depends on its fisheries resources, which in turn depends on a healthy environment. These destructive and illegal fishing practices impact heavily on the environment and also on the fishers and families who depend on fishing for their livelihoods.
The Government's policy is to protect the fisheries and the environment. By using these illegal fishing gear and practices the law is being broken, the environment is being damaged, fisheries resources are being destroyed and the livelihoods of many Cambodians are being negatively affected.



DISCUSSION POINTS

A. What does this picture show?

B. What is biodiversity?

C. Do you think biodiversity is important? Why or why not?

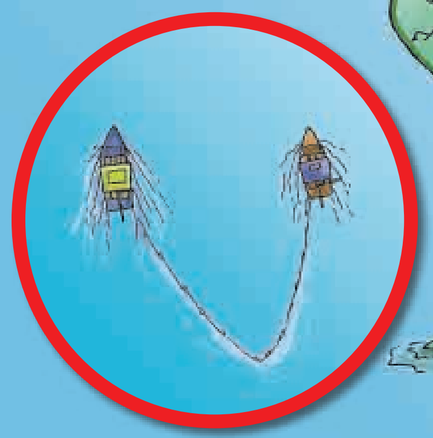
D. How many species of animals do you know from the Tonle Sap?

E. How many kinds of forests are there in Cambodia?

F. Where do flooded forests grow and why are they important?

G. What are the threats to biodiversity, eg. fish, birds etc. in Cambodia?

H. What can we do to better manage and conserve biodiversity?



45 minutes

ACTIVITY 1:
Interview an elder

Grade level: 4-8

Materials: Paper and pens / pencils

OBJECTIVES:

After this activity students can:

- Describe changes that have happened in their local environment
- Identify reasons why the local environment has changed
- Interview an older person about changes that have occurred in the local environment

MAIN IDEAS:

Growing human populations, pollution, over-harvesting of resources, and clearing of places where plants and animals live have caused impacts to our environment. Throughout the world, these impacts have increased over the past few decades. It can be difficult for students to imagine what has changed in the environment around them, especially if the changes occurred before they were born. Interviewing an older person provides students with an opportunity to learn about changes to their local environment from people who have experienced the change. It helps them to improve their knowledge about the environment and also to develop attitudes and values.

ACTION:

1. Start a class discussion by asking the students questions about changes that have happened in the local environment. The discussion should be based on the place surrounding the school and community where people live and work.
   - How has the environment changed here in the past 50 years?
   - What types of animals and plants do we see today?
   - What types of animals and plants might have been here 50 years ago?
   - Why do you think things have changed?
2. Explain to the class that they are going to interview older people from their community to find out how the environment has changed. The first step is to decide what sorts of questions the students would like to ask the older people. Encourage the students to make suggestions, and help them if needed. The following example questions can be used as a guide:
   - What has changed in the local environment since you were young?
   - What types of plants and animals did you see here when you were younger?
   - How did you catch fish in the past? Was it different than today's methods?
   - Is it easier or harder to catch fish today? Why?
   - How clean was the environment in the past (for example the water)? How has it changed?
   - Why do you think the environment has changed?

There are several options available for conducting interviews. You could invite some older people to the class to be interviewed. Alternatively, students could select an older person that they know and visit them to conduct the interview (individually or in small groups).

Encourage students to record written notes from the interview. When the interviews are completed invite students to share their findings with the rest of the class. Discuss how the students feel about the changes that have taken place. Would they prefer the environment of the past pr the present? What sort of environment would they like in the future? What could they do to improve the future environment?

BEFORE YOU START TO INTERVIEW:

Introduce yourself first

- state the objective of the interview clearly and tell them the period of the interview

INTERVIEW:

- Begin with introduction and friendly discussion with your interviewee in order to make sure all are relaxed to give answers
- ask the questions through the number and try to continue conversation until the questions have all been done
- be careful to ask the question in order to get good answer. eg don't ask questions
- make sure you understand all the questions clearly if not clear please allow them to answer it again if not clear and be sure you let them explain the words or ideas you don't understand.

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60 minutes

ACTIVITY 2:
Over harvesting

Grade level: 4-8

Materials: Paper and pens / pencils, flipchart picture small print outs of flipchart picture

OBJECTIVES:

After this activity students can:

- Explain how over-harvesting a plant or animal can cause its population to decline or disappear
- Identify local examples of plants or animals that are being over harvested
- Explain causes of over-harvesting
- Identify impacts to people from over-harvesting resources
- Suggest action that can be taken to prevent over harvesting
- Improve writing skills

MAIN IDEAS:

Over-harvesting is when people catch animals (such as fish or turtles) or cut down trees faster than they can reproduce and replace themselves. Over time over-harvesting can lead to a decrease in the population of the particular animal or plant, and can even lead to them disappearing entirely. Over-harvesting often occurs because of increasing human populations, or 'improved' technologies (such as nets, guns or saws) that allow us to harvest resources more quickly. Over-harvesting also occurs when people need to make money by harvesting resources to sell. Unfortunately over–harvesting provides only short-term profits because the resource will rapidly be used up.

ACTION:

1. Divide students into 4 groups then ask them to look at the picture in the flipchart. Ask two groups (selected by teacher) look at aunty Chan's commune and other two groups look at uncle Som's commune then describe what happen in the picture. Explain students that no right or wrong answer or writing and try to encourage them to write down into paper or book.
2. When they finish their writing, the teacher ask the group leaders to read it aloud in the class.
3. After the class has read their stories, ask students the following questions?

QUESTIONS:

a. What do you see is happening in Commune Chan?

b. What do you see is happening in Commune Som? Is there any similarities between this picture and your village?

c. Why is it important to allow fish to breed?

d. In order to avoid overharvesting, what should we do?

e. What impacts does fishing during the breeding season have on the amount of fish available in the future?

f. What methods of fishing may lead to fish shortages in the future? Why?

g. Why do people in Mrs. Chan's commune have enough food?

h. Why do people in Mr. Som's commune have shortages of food more often?

i. Which model, in aunty Chan or uncle Som's commune, should you follow? why?

j. When students finish answers, teacher read the sample story (provided) then ask them to copy it into their book.

CHANS'S COMMUNE 1

2

3

SOM'S COMMUNE 1

2

3

4

5

4

5a

or

5b

CONSERVATION OF BIODIVERSITY ACTIVITIES: MAPS AND FOOD CHAIN

HABITAT LOSS

Grade level: 4, 5 and 6

Materials: Paper and pens / pencils, chairs, role play cards

OBJECTIVES:

After this activity students can:

- Identify habitat loss in the local region and describe human activities that lead to habitat loss
- Explain the impacts of habitat loss to plants, animals and people
- Understand the links between plants and animals

MAIN IDEAS:

Deforestation and habitat loss:

Habitat loss occurs when human activities remove the places where animals and plants live. For example, a forest is home to many different types of plants and animals. If a forest is cut down, the animals and plants will lose their habitat or place to live. Activities that result in habitat loss include cutting down a forest to get wood and clearing trees and swamps to make rice fields. When habitat is lost the animals and plants that rely on the habitat will also disappear. This can affect people, because many of these plants and animals have valuable uses, such as providing a source of food, medicine, fuel or building products.

Food Chain:

Within the environment, living things interact in many ways, one way is through the feeding relationship. All plants and animals rely on each other to survive as one animal feeds on and the other. This is called the 'food chain'. These links between organisms are important because they represent how animals need and survive on each other for food and survival.

The Sun: every food chain begins with the Sun, the primary source of energy.

Producers: are plants and bacteria. They are called producers because they are able to make their own food. They convert sunlight into food energy in a process called *photosynthesis*.

Herbivores: are animals that only eat plants.

1st Carnivore: are animals that eat herbivores.

2nd Carnivore: are carnivores that eat other carnivores.

Omnivores: are animals that eat both plants and other animals.

An example of a food chain is shown in the flipchart illustration:

The Sun ➔ algae (plant) ➔ small insect eats plant ➔ larger insect eats smaller insect ➔ small fish eats insect ➔ large fish eats small fish ➔ human eats fish.

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30 minutes

ACTIVITY 1:
Option 1: Shrinking Habitats

Materials: 4 Role-play cards

This is a role-play activity, where students will act out the roles of people and animals that use the flooded forests of the Tonle Sap.

Choose four students to play the role of humans, remove these students from the rest of the class and provide them with a role card. Ask the remaining students to imagine themselves as an animal that lives in the flooded forests of the Tonle Sap (e.g. Frog, Fly, Water Snake, Giant Catfish, Saurus Crane, Siamese Crocodile, Gibbon, Turtle or Banteng).

Ask the students who are role-playing animals to each carry a chair and place them in a large circle. The circle should be big enough so that everyone can fit easily inside. Ask the students (with the exception of the four 'humans') to stand inside the circle. Tell the students that the circle represents the flooded forest habitat and that the students standing inside the circle represent the animals that live in the forest.

Explain to the students in the circle that this is their home (habitat) and that they all require space to live. But, unfortunately, there are many pressures on this habitat that affect their lives.

Ask the student with 'Role No. 1' card to come to the circle and read out their role. The activities read out by this student cause habitat loss. The student in role 1 should remove a few chairs from the circle. Some habitat is lost and the circle shrinks. Ask students what happened. How do they feel? Do they have enough room to move around?

Repeat the process with the student who has 'Role No. 2' card and so on until you have completed four rounds of the role-play. Note: after each round, the circle should be getting smaller, and at the end of round four, the circle should be very small so that the students inside do not have enough room to move. You may ask some students to leave the circle as it gets smaller; this represents a decline in the population. For some extra fun, you could ask these students to act out a 'dramatic death' as they are excluded from their habitat.

To make sure that the students understood the purpose of the above activity, have a debrief session with them. Ask students if they understood what was happening and how it relates to real life. Lead the discussion with the following questions.

- If this was a real situation, what do you think would happen to the animals and plants?
- How realistic was this activity? Does anyone know of examples of habitat where we live? Encourage students to share stories.
- How would the loss of animals (such as Catfish or Water Snakes) affect people?

Teacher's note: A long piece of string, rope or other objects such as shoes can be used as a substitute if chairs are not available for the role-play activity. For example, if you were to use string, the string would be shortened to reduce the size of the circle as the activity progresses.

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30 minutes

Option 2: Food chain

Let all participants name different animals or plants, which are available here and at the sun. Use piece of cotton thread with starting from point of sun and then stretch the cotton line strong to the point of plants and through animals in priority of eating until it reach all participants joining. Discussion with participants by asking some questions: How do you think about the cotton string tangled each other? Is it strong? What happened when there are shortages of some types of plants, animals, or humans? Why? How do we practice in order that the food chains are stable?

Teacher's note : Students conduct this activity outside or inside class. The number of students is unlimited. Ask students to record and analyse the relationship between sources of food.

30 minutes

ACTIVITY 2:
Compare the Maps

Show the students the maps of the Tonle Sap flooded forest (on the opposite side of the flipchart). The maps show the same region of Tonle Sap and show changes in the area is covered by ~~flooded~~ forest ~~and other land uses~~. The maps can be compared to show how the landscape has changed through time. Initiate discussion by locating landmarks on the map and asking questions.

Orient the students with the maps:

- Ask for volunteers to point out where the school and local community are located on each map. Discuss their suggestions – are they correct?
- Locate several well known landmarks or towns (such as Siem Reap, Angkor Temples or Kampong Chhnang)
- What year was the first map made? How many years ago was this?
- When was the second map made? How many years has passed between these two maps?

Discuss the differences between the maps, highlighting that these represent changes through a period of time:

QUESTIONS:

a. What are the differences between the two maps?
b. What was the area around our school / community like in the past (when the first map was made?) What is it like now?
c. How much of the flooded forest habitat has been lost? What has replaced the areas that were once forest?
d. What do you think has happened to the animals that lived in the areas of the flooded forest that have been removed?
e. How did people manage to change the landscape like this? Why did people make these changes?
f. Do you think these activities still continue today?
g. What do you think will happen to the flooded forest in the future?
h. What would happen to people of they could no longer catch fish, water snakes or other resources that rely on the flooded forest habitat to breed?
i. What could the community do to save the flooded forest?

Teacher's notes: Wild animals need space and resources to survive. For this reason they cannot simply move into a new area of forest when their area is destroyed. The 'new' area of forest will already have as many animals living there as the area can support.

j. Why does the destruction of the forest cause wildlife loss?
k. Why did the change in forest cover change?
l. Why don't you want to tell commune council or your parents when you see illegal activities?

2nd OMNIVORE
Human

1st OMNIVORE
Snake Fish
(Trey Ros)

Food energy

PRODUCERS
Algae

Food energy

HERBIVORES
Mosquito to larvae

2nd CARNIVORE
Climbing Perch
(Trey Kranh)

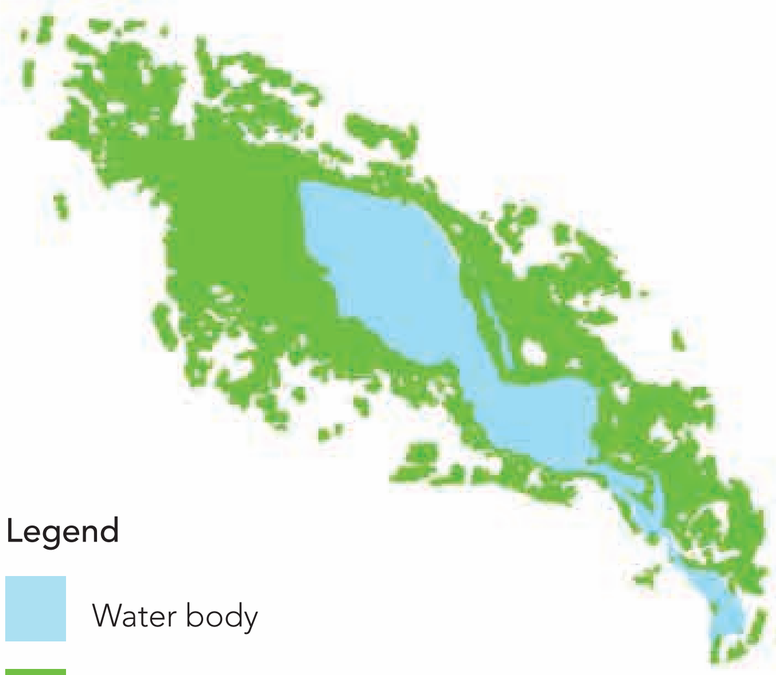
Food energy

1st CARNIVORE
Dragonfly larvae

Food energy

Food energy

Forest cover 1976



Legend

- Water body
- Forest

Forest cover 2002

60 minutes

LIVELIHOODS THEORY: A COMMUNITY'S ASSETS

To summarise some of key flipchart messages in terms of the 5 livelihood assets and identify vulnerabilities and linkages from the assets.

BACKGROUND INFORMATION

Understanding the assets a household or community have is an important part of making good livelihood choices. Community assets are the building blocks of the "quality of life" of a community and can be used directly or indirectly to generate livelihoods.

The following section discusses the concepts of **ASSETS**.

This flipchart has spoken about water, weather, waste, energy and biodiversity, which are all considerations for a good quality of life and sustainable livelihoods.

WATER: The amount of fresh water you have impacts your livelihood choices. If you don't have much or you have too much it may impact the crops or animals you choose. It may even impact where you live: if you don't have clean water for drinking it may impact the health of your family and you and reduce your ability to work.

WEATHER: Rainfall is a key consideration if there is too much you may get floods or if there is too little you may get droughts. Knowing the weather cycles or climate is very important in growing crops and raising animals.

WASTE: Waste are the things that are not used effectively – but some people's wastes can actually be resources. Organic scraps can be composted for crops or fed to animals thereby reducing the need to buy fertilisers or feed.

ENERGY: The most important energy is your own – you need to eat well so you can develop your mind and muscles – these are **human assets**. A good mind and muscles can help you make good livelihood choices and have the energy to make good use of these.

BIODIVERSITY: Every living thing that surrounds us is biodiversity and forms part of our **natural assets**, from the flooded forest that provides a nursery for fish to the birds that attract tourists, we need to conserve and manage natural assets for the future.

A COMMUNITY'S 5 ASSETS

1. Social Assets:

The social networks of a community form to create social assets. Family relationships, tribal connections, language, shared values, trust, and culture all contribute to social assets. Social assets and its components are the essential building blocks of a vibrant and effective civil society.

This asset includes the people and networks involved in communications and solutions to problems existing in a community. If individuals do not actively participate in their community, the strength of this assest decreases.

2. Physical Assets:

Physical Assets are those assets which can be seen and touched. It refers to physical machinery and tools used for productive activities and also buildings, roads and social services. Some examples are: tractors, plows, seeds, fertiliser, livestock, roads, streets, hospitals, health centre, pagoda, transportation, water supply, sanitation, energy supply, communication and so on.

3. Human Assets:

People are the basis of human assets. Education, technical skills, leadership, knowledge, creativity and health are some examples of human assets. This asset refers to the potential of people, and is often the most cost effective asset to build on.

For example: In a community fishery, human assets refers to the knowledge, skills and physical power of its committee members.

For a farmer, in order to grow vegetables/rice with high outputs, what capacity, knowledge and skills should the farmers have? The farmer also needs the physical labour to do the work.

4. Natural Assets:

Essentially, natural assets are a community's base of natural resources: land, forest, water biodiversity and minerals. These resources provide overall benefits for all such as; climate, land, water, mountain, biodiversity, forests, flooded forests, fishes and birds.

These resources are very significant for human beings because we can make our livelihood through sustainable use of these. Many of our activities rely on use of natural resources, eg. fishing, agriculture, forests and NTFPs and Ecotourism.

5. Financial Assets:

Financial assets refer to savings, credit, loans, income, salary, cash, debt and other valuable items with the potential of being sold. Financial assets covers most of which is traditionally referred to as an asset, however it should also be mentioned that financial assets are a way to get other assets.

POLICIES, INSTITUTIONS, AND PROCESSES (PIPS)

A community's livelihood assets are influenced by, and reflect the policies, institutions and processes in the community around them on a broader scale and at a national level.

It refers to the specific structures such as the Government and NGOs and policies such as taxation, rule of law, and property rights. Other factors at the community level are village organisations, local representation, and ability to access government programs and entitlements.

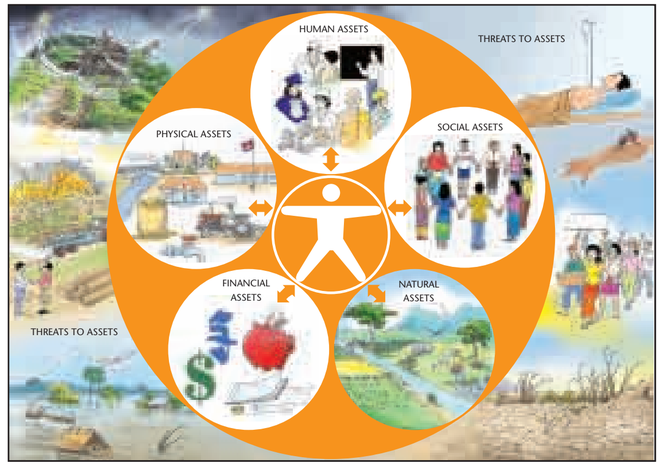
These policies, institutions and processes may have positive or negative impacts on communities livelihoods and as such should be considered in making good livelihood choices.

VULNERABILITIES: OR THREATS TO ASSETS

For a prosperous community, it is important to maintain and nurture each of our 5 assets. Assets can be directly and indirectly affected by external events or situations that are beyond our control. For example, natural disasters such as earthquakes, drought, storms or floods affect some communities. Others are continually impacted by health epidemics such as malaria and HIV/AIDS. Potential threats also include economic changes, political unrest, technological advancements and corruption.

We need to safeguard against these threats, as damage to our assets can impact negatively on our livelihoods.

The importance of understanding vulnerability is paramount as we need to safeguard our assets, so that we can maintain a good quality of life.



DISCUSSION POINTS

A. What does this picture show?

B. What are the 5 assets?

C. Can you give an example of each?

D. Can you explain how damage to one of the assets could impact on our livelihood?

E. Can you give an example of how damage to one asset could impact on an another asset?

F. What advantages do human resources provide?

G. What are social assets? Why are they important?

H. How are other assets linked together?

I. What could we do to increase our assets?

HUMAN ASSETS

PHYSICAL ASSETS

SOCIAL ASSETS

FINANCIAL ASSETS

NATURAL ASSETS

THREATS TO ASSETS

THREATS TO ASSETS

DEMOCRACY

60 minutes

LIVELIHOODS ACTIVITIES: WATER & HEALTH

Grade level: 4, 5 and 6

Materials: Paper and pens / pencils, drama list

OBJECTIVES:

After these activities students can:

- Develop problem solving skills
- Develop thinking and reasoning skills
- Take responsibility for their own family water hygiene
- Understand and make connections between water contamination and water management

MAIN IDEAS:

Drinking contaminated water can cause serious illness. When people have poor health it is difficult for them to go to work to make a living. A sick person will find it difficult to go to work, and will earn less money or grow less food. Medical treatments are also very expensive, and this combined with loss of income can lead to poverty. Therefore good health (and clean water) is essential if we are to maintain a good livelihood & reduce poverty.

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40 minutes

ACTIVITY 1:
Connection between water pollution health and livelihoods

1. Divide participants into four groups. Ideally each group should have six members, however this isn't essential. Provide each group with one of the lists from the table below.
2. Ask each group to prepare a short drama / role-play that must include each of the six objects or people on their list. The participants are allowed to speak during the performance and may like to develop a script (this is optional). Students can look at the picture on the front of the flipchart, each group has a colour coding to help them get ideas for their play.

   Explain that the list can be arranged to tell a story that shows relationships between water, pollution, health and peoples lives. There is no right or wrong order to use the objects or people (from the list) in the drama.

   Allow sufficient time for the groups to prepare a drama performance (e.g. 15-20 minutes), and 5 minutes for each performance.
3. After each performance ask the class the following questions:
   a. What was the message in the performance?
   b. Do you agree with the links that were made between water pollution and poverty? Why?
   c. Ask the performers: did you get your message across?
   d. What were the relationships that you were trying to show? Is this a realistic situation in your community?

List 1 blue group	List 2 green group	List 3 red group	List 4 yellow group
• A hungry family • A person going to the toilet • A person drinking water from the river • An angry boss at a factory • A father with no money • A very sick person	• someone throwing rubbish in the river • A family eating a meal of just rice • A person drinking water from the river • A very sick person • Someone buying medicines • A poor man with no money	• A person buying food from the market • A woman cleaning the roof • A person coming home from work • People drinking water • People eating fish and rice • Breast feeding mother	• A baby • Someone using a water filter • A person drinking • Someone washing motorbike in the river • A person with diarrhea • A cow going to toilet in river

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50 minutes

ACTIVITY 2:
Fishy tale

1. Explain to the class that they are going to role-play and see the world from the perspective of a fish living in a nearby stream or in the Tonle Sap.
2. Ask the students to imagine they are a fish. Ask them to close their eyes for a few minutes and imagine what their surroundings look like and what life is like in their natural environment. Encourage participants to share what they imagined with the group.
3. Explain to the students that unfortunately their home (habitat) is getting polluted because of sewage and rubbish that people are dumping in the water.
4. Now ask them to close their eyes again for a few minutes and imagine what their surroundings look like and what life is like in their dirty environment. Encourage participants to explain what they imagined.
5. Encourage the students to write a letter to a fisherman who makes a living from catching the fish. Have students describe the place where they live and how they feel about all the pollution that is in their home.
6. When students have finished writing their letters, select some students to read their letters aloud to the class.
7. Discuss using the following questions:
   a. How do you think pollution could affect the health of wildlife such as fish?
   b. How realistic is this situation in the community where you live?
   c. What types of wastes enter the water and where do they come from?
   d. Who is responsible for this waste?
   e. What affect could the reduction in fish numbers have on people?

Teacher's note: *Consider an alternative to this activity: Instead of writing to another fish, ask participants to write a letter to the community or Government explaining their situation.*

For example:

Dear Sophy,

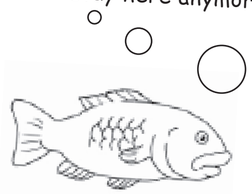
Hi, how are you? Hope you are fine. I'm sorry if you haven't been catching any fish lately – you see many of my friends have left this part of the river. My friends Sopheap, Bunthan, Sambath and Bunchheoun are all gone forever. Oh! Not forgetting my cousin Sokun and his wife Karen cannot give birth to childrn beachse the place is full of ollution with many kinds of waste. Also all my babies have been caught, and you were not supposed to take them. This is illegal!

You might be wondering why I am writing this letter. This is because everyone's toilet wastes are dumped in my home. People and children who go past me cover their noses because they can't bare the smell of my home.

Forget about me because my fins are losing their color from the pollution.

So, goodbye to you and farewell. Maybe you should try to grow some rice for food, because we fish cannot stay here anymore.

From the fish



20 minutes

LIVELIHOODS: REVISION & GAME

Objective: summarise key messages of the flipchart in an interactive and enjoyable way

BACKGROUND INFORMATION

This flipchart has covered many topics of relevance to your everyday life, including: weather, water, waste, energy, and biodiversity. All of these topics also link to our livelihoods: the following summarizes some of the sessions and makes links to livelihoods.

WEATHER MODULE

The weather is very important for all living things but the bad weather such as too much water in the wet season and not enough water in the dry season, can affect to our daily lives. Cambodia has two distinct seasons: the wet season and the dry season. The wet season is May to October, the dry season is November to April. Knowing about seasons is important to us to prepare every things for our many livelihoods. Rain water is very important because it is likely to be cleaner and safer than river or well water except rain acids so we should make a supply of rain water to last longer by catching rain water during the wet season (rain season).

WATER MODULE

Every one needs clean water for drinking because it is safe. Our drinking water comes from rivers and streams, bores, and ground wells, rain water and piped water. The main A major problem for people is access to clean water. For example, toilets often go straight into our waterways, and many people and animals use waterway as their toilet. Unfortunately, lakes and rivers polluted with sewage are often the only source of water in local area. Rubbish and chemicals also contaminate water, these may come the communities where we live or from industries. Waste that enter water sources can have potential health impacts and cause other environmental problems. Drinking water needs to undergo a process of purification. eg. boiling constantly for 15-20 minutes or using a ceramic water filter. To make sure that our drinking water is safe, we can use the H2S water test tube to test the water.

WASTE MODULE

There are two main groups of waste: organic and inorganic. Inorganic waste may break down, but the process can take a very long time, sometime thousands of years. When inorganic wastes do eventually breakdown, they may release chemicals that can also cause pollution. If people throw their waste into the water, it will become contaminated, and if people drink that water and eat the fish from a polluted water they may become sick. It is not safe to burn plastic waste, such as plastic bag, wrappers or drink bottles. When burned plastics release toxic chemicals that are harmful to our health.

Organic wastes are better as they break down easily in the environment, such as paper, food and plant materials. Organic waste disposed of into the street can encourage rats, flies and other pests, which can also will spread disease. Organic waste shouldn't be thrown away because they can be use to improve the soil for gardens and crops. These organic wastes can be composted. Compost is one of nature's best mulches and soil fertilisers. Best of all, compost is free.

ENERGY MODULE

Energy is the ability to do work. There are many different energy sources. Some are "renewable " that is can be easy made or renewed. Sources of renewable energy should never run out: solar, wind geothermal, biomass, hydropower etc... . Nonrenewable energies are those that can not be easily made and gradually run out as they are used up: oil, natural gas, uranium (nuclear), coal etc... . Wood is a renewable fuel, because trees are able to re-grow. How ever, if too many trees are cut down, and new trees do not replace them, the forest quickly disappears and so does the future supply of wood. This is happening in the Tonle Sap, where forests have been cleared and not replaced.

CONSERVATION OF BIODIVERSITY MODULE

Biodiversity is very living thing including humans: it provides food and other basic needs for our lives. As an example the Tonle Sap has around 200 species of fish, 42 species of reptiles, 225 species of birds and 46 species of mammals. In Cambodia, there are 6 kinds of forests such as green forests are always green each year, leaf-dropping forests, mangroves forests in the coastal zone, flooded forests surrounding the Tonle Sap, bamboo forests, and pine forests. The most significant threats are hunting, habitat degradation or loss and illegal activities.

LIVELIHOODS MODULE

There are 5 community assets: physical, natural, financial, social and human.

1. Physical assets are those could be seen and touched such as Roads, streets, schools, hospitals, monastery, transportation, housing, water supply, sanitation, energy and communication and so on.
2. Natural resources are focused on variety of resources, which provide overall benefits and advantages such as climate, land, water, mountains, biodiversity, forests, crops and animals. These resources are very significant for people's livelihoods.
3. Financial and economic assets can be included finances which can be gained through saving, loan, regular income, daily income, salary, remittances, donor, business, farming, and so on.
4. Human resources are concentrated about skills, knowledge, capacity and health which make human able to perform jobs and to make business and so on, opportunity for working and study.
5. Social-culture assets are those people can be involved in communications and solutions of all problems existing in society or community. These resources are produced and created such as working network, communication group, or any organization and other cultural services.

50 minutes

ACTIVITY:
Revision game: Snakes & Ladders

Grade level: 4, 5 and 6
Materials: Game, dice and some stones or objects to use as pieces

Now that you have finished all the modules and lessons in the flipchart, students can play the Snakes & Ladders game.

1. Divide the class into smaller groups, ideally each group should have 4-6 students.
2. Give each group a copy of the game, and a dice. If you do not have a dice you can put the numbers 1-6 on pieces of paper and in an opaque plastic bag.
3. Each group plays the game by throwing the dice. They move their piece forward the number of places as shown on the dice. If they land on a ladder, they move their piece up - if they land on a snakes head, they must slide down the snake and stop on its tail.
4. Students should read out the information on the square that they land.
5. Once you have finished the game you can ask the students some questions:
    a. What can you learn from this game?
    b. What is the importance of this game?
    c. What is the snake symbol referring to?
    d. What does the ladder refer to?