
Teaching Methodology for Environmental Life Skills Education for Teacher Training Centers

2013

Unofficial translation

Teaching Methodology for Environmental Life Skills Education for Teacher Training Centers

Published by the Ministry of Education, Youth and Sport of the Kingdom of Cambodia

Printed in Cambodia, 2013 (First edition)

The development and publication of this document has been funded by the General Directorate of Development Cooperation and Humanitarian Aid (DGD) with technical support from the Flemish Association for Development Cooperation and Technical Assistance (VVOB). The Flemish and Belgian governments cannot be held responsible for the content of this publication.

Copyright Notice

Unless otherwise noted in the materials excluded and rights reserved list below, material in this publication is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 3.0 Unported License. This means that you may distribute copy, remix and build upon this work non-commercially without prior permission of the publisher, as long as you credit and license your new creations under identical terms. More information on this license is available at <http://creativecommons.org/licenses/by-nc-sa/3.0/>

Material excluded and rights reserved

Some material in this publication is not being made available under the terms of this license. These are Third-Party materials that are being used under fair use or with permission. The publisher will not be liable on any legal basis (including negligence) for any loss or damage suffered through the use of Third-Party material.

Preface

Nowadays, the world pays close attention to climate change and the depletion of natural resources which are basic needs of humans on the earth. Meanwhile, scientists and experts have increased their efforts to find out how to prevent those problems and possible impacts on the earth. In the bid to prevent these problems from happening, our working group and SEAL programme of VVOB (Belgium) in association with the Ministry of Education, Youth and Sport have collected and compiled this document as reference for environment teacher trainers and student teachers' teaching.

On behalf of the Ministry of Education, Youth and Sport, I profoundly thank the working group and SEAL project (VVOB) of Belgium for compiling this document.

If there are any accidental mistakes or errors in this document, we are happy to accept suggestions and feedback.

Phnom Penh, 17 June 2013
Minister of Education, Youth and Sport

COMMITTEE OF AUTHORS OF ENVIRONMENTAL LIFE SKILLS MANUAL

A. Management Committee

His Excellency Nart Bunroeun

Secretary of State, Ministry of Education, Youth and Sport

B. Quality Assurance Committee

Mr. Leang Seng Hak	Director of Teacher Training Department
Mr. Eng Kim Ly	Director of Curriculum Development Department
Mr. Chan Sophea	Director of Primary Education Department
Mr. Ra Vuthy	Director of Vocational Orientation Department

C. Authoring Committee

Mr. Leav Ora	Director of Siem Reap Provincial Teacher Training Center
Mr. An Chhut	Dep. Director of Siem Reap Provincial Teacher Training Center
Mrs. Pril Sokros	Teacher Trainer of PTTC Siem Reap
Mrs. Chhit Sophy	Teacher Trainer of PTTC Siem Reap
Mrs. Rith Darinhet	Teacher Trainer of PTTC Siem Reap
Mr. Smin Sou	Teacher Trainer of PTTC Siem Reap
Mr. Choup Sam Ol	Teacher Trainer of PTTC Siem Reap
Ms. Ho Sokley	Teacher Trainer of PTTC Siem Reap
Ms. Wanda Prins	VVOB SEAL Program Coordinator
Mr. Koy Maquis	VVOB SEAL Program M&E Officer and Facilitator
Mrs. Nadia Reynders	VVOB SEAL Program Coordinator
Mr. Ra Chanroat	VVOB SEAL Education Advisor

D. Committee of Revision and Organization

Mr. Chea Phon	Dep. Director of Teacher Training Department
Mrs. Ouk Chakrya	Dep. Director of Vocational Orientation Department
Mrs. Seak Sokny	Officer of Teacher Training Department
Mr. Ouk Dara	Officer of Teacher Training Department
Mr. So Chanborey	Officer of Curriculum Development Department
Mrs. Huy Chanthou	Officer of Curriculum Development Department
Mrs. Thorng Chandavoin	Officer of Primary Education Department
Mr. Nay Sacha	Officer of Primary Education Department
Mrs. Ven Vandeth	Officer of Vocational Orientation Department

Preface

The Environmental Life Skills document is compiled under collaboration with the Ministry of Education, Youth and Sport, trainers in teacher training school in Siem Reap and VVOB's SEAL project technician assistance of Belgium.

This book provides briefing notes for trainers, teachers in teacher training centres and primary schools to use as their reference in teaching environment life skills.

All the lessons in this book mainly focus on increasing awareness; it contains findings on environmental issues, life skills development, solutions, decisions and considerations in a bid to make teaching activities and the learning process of teachers to have better outcomes.

The book is composed for broadening teachers' knowledge of environmental issues in which the world is interested in nowadays and pay close attention in order to avoid, reduce and take measure to prevent the issues or event caused by environment.

This Environment Manual has been checked for accuracy by the Centre for Environment Education India and Live & Learn Cambodia. VVOB wishes to thank both organisations for their support. Osmose has been supportive with providing pictures for the manuals and posters for the Teacher Training Centres and practice schools.

The author group hopes that the book will contribute to improve the environment in Cambodia and provide more benefits for learners as well as the general population who wishes to sustainably live in a clean and healthy environment.

We are happy to accept your constructive criticism.

Authors Group

Note

This book is the translation of វិធីបង្រៀនការអប់រំបំណិនជីវិតស្តីពីបរិស្ថាន (the training manual Teaching Methodology for Environmental Life Skills Education for Teacher Training Centers) which was issued in 2013 by the Ministry of Education, Youth and Sport (MoEYS). This translation was made by VVOB (the Flemish Association for Development Cooperation and Technical Assistance) and is not an official translation. We hope it may be useful to External Development Partners of MoEYS and Teacher Training Centers who wish to consult the original Khmer manual in English.

INTRODUCTRION TO THE ENVIRONMENT LIFE SKILLS TEACHING MANUAL

This teaching manual, together with the content manual for environmental life skills, provides a range of ideas and methods that are suitable for environmental life skills education for future teachers. The lessons for environmental life skills education stimulate awareness building, foster a deeper understanding of environmental issues, and develop skills such as problem solving, decision making, persuasion, and critical thinking. They also provide opportunities for action which can lead to behaviour change. Student teachers learn how to apply this methodology with students in primary schools.

Definition of Environment Education

“Environmental education is a process aimed at developing a world population that is aware of and concerned about the total environment and its problems and which has the knowledge, attitudes, commitments and skills to work individually and collectively towards action to solve current problems and to prevent of new ones.” UNESCO

Objectives of the Environmental Life Skills lessons

After completion of these environmental lessons according to the curriculum student teachers will become teachers who:

- Have a broad understanding of environmental issues in Cambodia and the actions that could be undertaken to address these problems.
- Have changed their attitude and behaviour in relation to the environment.
- Have methodological skills to transfer understanding, attitude and behaviour change related to environmental issues to primary school students.

Student centered approach

This teaching manual provides ready to use methods and activities, accompanied by teaching aids such as posters, pictures, videos, and materials for experiments. It is always important to apply a student centred approach. A student centred approach is an educational

Definition of Life Skills

‘The intellectual, personal, interpersonal and vocational skills that enable informed decision-making, effective communication, and coping and self-management skills that contribute to a healthy and productive life to ensure successfully solving daily problems’.

*Policy for Curriculum Development 2005-2009,
Ministry of Education, Youth and Sport*

method designed to motivate students to participate in the lesson. Examples of activities that motivate students to be involved in the lesson include demonstrative experiments; educational games; creative arts and performing; role plays; discussion and debate; learning-by-doing; survey or small research; and taking part in an awareness raising campaign. All of these approaches can be found in this manual.

The lessons described have references to teaching aids which can be used for each activity. In the lessons you can also find clear references to the accompanying paragraphs in the content manual.

Activities described in each lesson are designed to take 40 minutes of teaching time, which allows 5 minutes at the beginning and 5 minutes at the end of each lesson, so that teacher trainers can teach according to the 5 steps of the Ministry of Education Youth and Sports (MoEYS).

Use of multimedia

Environmental issues can also be brought into the class room through the use of video clips, flash animations, PowerPoint presentations and photos. They provide different learning opportunities which focus on awareness building and attitude change. However multimedia provides information only and a discussion afterwards is needed to give understanding and meaning to this lesson activity.

❑ **DVD 1 and 2** provide documentary video clips to be used in the environment lessons. If a documentary or video clip is used to provide information about a specific topic, the manual also offers ideas for a follow-up activity that facilitates a discussion of the topic in class, and may help to change attitudes related to that topic.

🎵 **Disc 3** provides flash animations, PowerPoint presentation and photos.

❑ **DVD 4 – 7** contains video clips that show teaching activities described in this manual. This will provide an opportunity to see how an educational game is played, or how a teaching activity is explained to the student teachers. This helps teacher trainers to understand the activity before the lesson is given. These video clips could also be used in Pedagogy lessons for student teachers to observe and discuss the advantages or downsides of using certain activities.

You may find that there are too many activities and you do not have enough time to do all in your lessons. Then keep in mind each year on the 5th of June World Environment Day is celebrated internationally.

The extra activities such as educational games, extra video clips, making art work, writing stories or poems contest can be part of the celebration of World Environment Day at the PTTCs to give ideas to student teachers how to promote awareness on the importance of protecting biodiversity, the forest, the rivers and the overall environment of Cambodia.

Definition of Life Skills Education

“Life Skills based education is used to empower young people in challenging situations. It involves an interactive process of teaching and learning, which enables learners to acquire knowledge and develop attitudes and skills to support the adoption of healthy behaviours.”

UNICEF

Table of Contents

Chapter 1 Introduction to Environment	1
1.1 Background information	1
1.2 Objectives	1
1.3 Teaching aids	1
1.4 Teaching procedure	1
1.4.1 Lesson 1 Definition of environment	1
1.4.2 Lesson 2 Education for sustainable development	2
Chapter 2 Biodiversity and Ecosystems	4
2.1 Background information	4
2.2 Objectives	4
2.3 Teaching aids	4
2.4 Teaching procedure	4
2.4.1 Lesson 1 Biodiversity	4
2.4.2 Lesson 2 The Ecosystem and Wetlands	7
Chapter 3 Natural Resources and Impact of Overuse	8
3.1 Background information	8
3.2 Objectives	8
3.3 Teaching aids	8
3.4 Teaching procedure	9
3.4.1 Lesson 1 Forest in Cambodia	9
3.4.2 Lesson 2 Deforestation	10
3.4.3 Lesson 3 Wildlife	11
3.4.4 Lesson 4 Mining resources	12
3.4.5 Lesson 5 Climate Change	13
Chapter 4 Waste Management at PTTC/schools and community	15
4.1 Background information	15
4.2 Objectives	15
4.3 Teaching aids	16
4.4 Teaching procedure	16
4.4.1 Lesson 1 Different kinds of waste and waste segregation	16
4.4.2 Lesson 2 Disadvantages of waste	18
4.4.3 Lesson 3 Bio-degradable and non-biodegradable waste	19
4.4.4 Lesson 4 The 3R'S: Reducing, Reusing and Recycling	21
4.4.5 Lesson 5 Survey on plastic bag use in the school	22
4.4.6 Extra activity: Educational Game "Use & Throw"	23
4.4.7 Extra activity Campaign on a plastic bag and packaging free school	24
4.4.8 Extra activity Campaign to reduce plastic bags in the community	25
Chapter 5 Pollution in Cambodia	26
5.1 Background	26
5.2 Objectives	26
5.3 Teaching aids	26
5.4 Teaching procedure	27
5.4.1 Lesson 1 Air pollution	27
5.4.2 Lesson 2 Waste disposal in Cambodia	28
5.4.3 Lesson 3 Educational Game on Waste Disposal	29
5.4.4 Lesson 4 Plastic bag problem in our village	30
5.4.5 Lesson 5 The importance of water	30
5.4.6 Lesson 6 Polluted and Clean River	32
5.4.7 Lesson 7 Preparation on water sources survey	33
5.4.8 Lesson 8 Reporting on water sources survey	35

5.4.9 Lesson 9 Water cycle and environment.....	36
5.4.10 Lesson 10 Safe Water Consumption.....	38
5.4.11 Extra activity 1: Art work - Water Drawings	40
5.4.12 Extra activity 2: Erosion and water pollution	40
Chapter 6 Environment of River.....	42
6.1 Background.....	42
6.2 Objectives.....	42
6.3 Teaching aids.....	43
6.4 Teaching procedure	43
6.4.1 Lesson 1 The importance of the Mekong River.....	43
6.4.2 Lesson 2 Consequences of hydro dams	43
6.4.3 Lesson 3 Illegal fishing	46
6.4.4 Lesson 4 Tonle Sap Lake conservation.....	47
Annex list.....	49
List of multimedia.....	81
List of pictures.....	84
List of posters.....	84
References.....	85

Chapter 1 Introduction to Environment

1.1 Background information

Our environment is everything around us, including living and non-living things. The environment can be categorized into 3 parts: the natural environment, the socio-cultural environment and the human environment.

Environmental education is the learning and teaching process designed to improve knowledge, improve skills, and change attitudes with respect to the environment, and challenges within the environment. Developing the necessary skills means to be able to solve challenges, and to develop motivation and commitment to make wise decisions and to be accountable for them.

1.2 Objectives

At the end of this chapter student teachers

Knowledge

- know the definition of environment and can correctly identify the different parts of the environment, through the use of brainstorming tasks and word card classification tasks.
- can describe the environmental problems of Cambodia, and understand the meaning of education for sustainable development, through the reflection on provided case studies.
- can describe positive characteristics of education for sustainable development in group discussion.

Skills

- apply positive habits related to the environment in order to contribute to the country's development, by focusing on the sustainability of the 3 parts of the environment.

Attitude

- promote the importance of living in a clean environment.
- integrate environmental education into their teaching practice to create motivation among the pupils to help improve the environment.

1.3 Teaching aids

Lesson 1 Small blank papers, flipcharts and markers

Lesson 2 Case study papers (see Annex 1.4.2) Flipcharts, crayons

1.4 Teaching procedure

1.4.1 Lesson 1 Definition of environment

Activity 1: Brainstorming ideas (10 minutes)

Content book 1.1

- The teacher trainer distributes 3 blank pieces of paper to each student teacher and asks them to write down anything they see around them.
- Ask student teachers to report on what they have written to the class.
- Ask for a definition of 'environment'?

Expected answer:

The environment is everything around us, including living and non-living things.

Activity 2: Word cards classification of the environment into 3 parts (10 minutes)

Content book 1.1 “A-C”

- The teacher trainer explains that our environment may be categorized into 3 parts: natural environment, socio-cultural environment and human environment, and puts the word cards of the 3 categories of environment onto the blackboard. (natural/socio-cultural/human).
- Ask student teachers to put their written cards of activity 1 in the right category on the blackboard.
- The teacher trainer asks following questions:
What is natural environment?
What is social - cultural environment?
What is human environment?
- The teacher trainer and students together correct any cards that were put into the wrong place.
- The teacher trainer summarises the activity.

Activity 3: Group discussion of the 3 parts of the environment (20 minutes)

Content book 1.1 “D”

- Divide student teachers in several groups consisting of 4 members.
- Student teachers discuss the aspects of the environment of their own villages (3 parts of their environment). They should write down a few examples of each of the three parts of the environment with reference to their own village or town.
- Each group reports the interesting points to the class so as to discuss to find out the overall points whether the environment of each of the student teacher's villages/towns differs. How do the differences relate to each other?
- The teacher trainer records the key points on the blackboard.
- Reflection and conclusion.

1.4.2 Lesson 2 Education for sustainable development

Activity 1: Brainstorming questions (5 minutes)

Content book 1.2

- 1) What are challenges of the environment in Cambodia?
Expected answer: climate change, destruction of natural resources.
- 2) What should we do to sustain the environment in Cambodia?
Expected answer: promote education about the environment and utilize environmental resources in a sustainable way.

Activity 2: Group work using a case study (25 minutes)

Content book 1.3

- Divide student teachers into 4 groups.
- Distribute 1 case study to each group, and ask them to read it. There are 4 different case studies in Annex 1.4.2. Ask students to identify and write down topics in the case study, classified as either “human” or “environment”. For example, if education causes problems we write it down under human.
- The teacher trainer instructs the student teachers to draw a big egg on a flipchart, using colours as shown below, and explains the meaning of each colour as follows. The yellow part of egg represents human activities (economic, society and politics status related to human activities). The white part represents the environment. Student teachers use crayons to colour the yellow part of the egg based on the severity of problems. For example, if there is a serious problem, the student teacher should colour that part of the yolk with a very dark grey shadow, but if the problem is less serious, they colour that part of the yolk with a lighter grey shadow.
- Ask each group to discuss their own case study and draw an egg to represent the environmental status in their case study.
- Ask a representative from each group to describe the meaning of their egg picture.

- Reflection question: Among the 4 case studies, which case study shows the most positive situation and why?
 - The teacher trainer summarises the main conclusions of the activity.
- ☐ **DVD 4 clip 1.4.2 Teaching activity: Group discussion on case study (15 min)**



Picture 1 Case study using egg-drawing

Activity 3: Explanation of sustainable development (10 minutes) **Content book 1.3**

- The teacher trainer asks the following questions:
 - 1) What is sustainable development?
Expected answer: It is development that prioritizes keeping the environment healthy and ensures the availability of natural resources for current and future generations at the same time.
 - 2) What are the characteristics of education for sustainable development?
Expected answer: Envisioning, critical thinking, systematic thinking and building partnerships.
- The teacher trainer summarises the main points of the lesson.

Chapter 2 Biodiversity and Ecosystems

2.1 Background information

Biodiversity simply means the variety of life living in different areas of the earth. Each kind of living thing has diverse key functions within the ecosystem. Biodiversity is vital for the daily life of people. If biodiversity is stable then the ecosystem is stable too.

An ecosystem is a biological environment consisting of all the organisms living in a particular area, as well as all the non-living, physical components of the environment within which the organisms interact, such as air, soil, water, and sunlight.

Wetlands are an example of an ecosystem. The Ramsar Convention (The Convention on Wetlands) is an international treaty for the conservation and sustainable utilization of wetlands. Its goal is to stem the progressive encroachment on and loss of wetlands now and into the future.

2.2 Objectives

At the end of this chapter student teachers

Knowledge

- can describe the meaning and functions of biodiversity correctly, which they have learned in the outside class activity, comparison, web-life game and brainstorming questions.
- know the definition of ecosystem.
- remember the special characteristics of wetland areas which they have learned through drawing tasks, map observation in pairs and brainstorming exercises.

Skills

- can identify alternative solutions to prevent loss of biodiversity and take action to conserve biodiversity.
- can identify positive impact as a result of wetland conservation in Cambodia.

Attitude

- show a positive attitude to conserving biodiversity.
- have learned to avoid behaviour which can adversely affect the ecosystem and the wetland.

2.3 Teaching aids

Lesson 1 Markers, paper tape, small blank papers, coloured paper, rope, flipchart and picture cards (see Annex 2.4.1). DVD 1 clip 2.4.1 video clip “Natural resources conservation” and video clip 2.4.1 “Protection and naming of vegetation”, DVD player/laptop or TV/projector

Lesson 2 A5 paper, copies of Wetland map and Outline Map (See Annex 2.4.2) and on DISC 3 as slide

2.4 Teaching procedure

2.4.1 Lesson 1 Biodiversity

Activity 1: Outside observation of the environment (15 minutes)

Content book 2.1

- Divide student teachers into 4 groups and ask them to go to the following designated places:

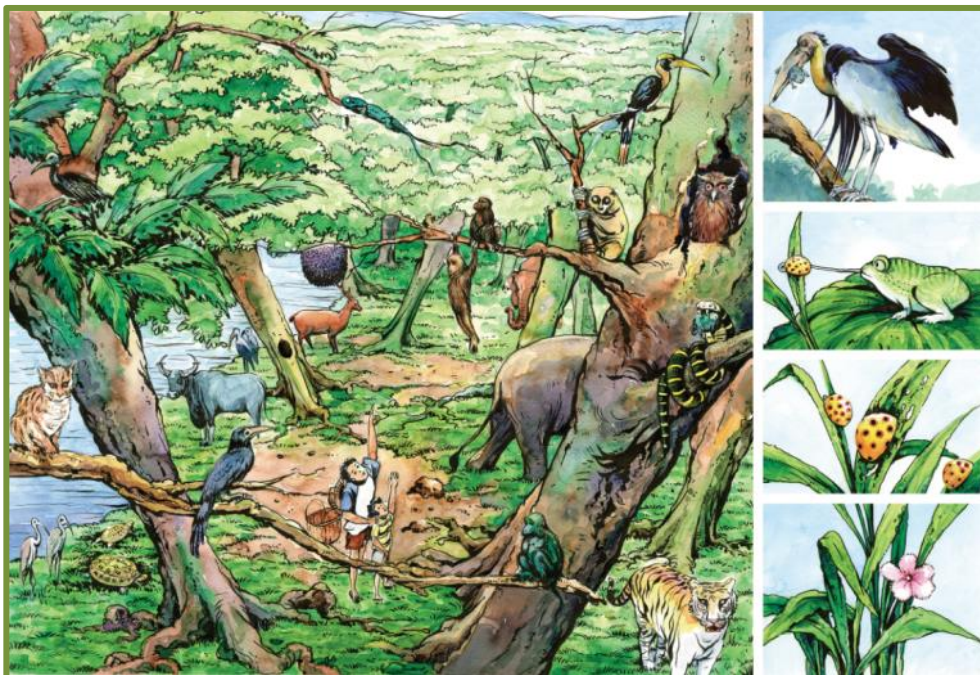
- Group 1: A flower garden
- Group 2: A place that does not have any trees
- Group 3: A place that has many big trees
- Group 4: (Fish) Pond
- Ask each group to observe and record the names of animals and plants that they can find (how many animals and plants?).
- Each group representative reports on the results of their findings.
- Reflection question: What is biodiversity?
- Expected answer: Biodiversity means that different living things live in different areas on the earth.
- Compare the amount of biodiversity at each of the 4 places. Which place has the highest number of animals and plants? Why? Why do other places have less? Do those places have the same animals and plants? Why?
- The teacher trainer explains the status of biodiversity in Cambodia, summarises the main points of the lesson, and explains the overall result.

Activity 2: Educational game “Web of life”¹ (20 minutes)

- Ask student teachers to stand in a circle, inside or outside of the classroom.
- Distribute 1 picture card (living and non-living things, see Annex 2.4.1) to each student teacher.
- Instructions of the game: A student teacher holds one end of the rope and passes the end of the rope to another according to the relation between them. For example, a human eats fish, and the fish needs water, etc.
- Reflection questions: What does the rope stand for? If an animal disappears, what will happen? What does the rope connection from one student teacher to another mean? Why does biodiversity get unstable?

Expected answers: The rope is the connection from one part of biodiversity to another. When an animal eats another animal the rope is still tight because the loss is replaced by a new animal. When the rope is tight all living things on earth have a relationship with each other. But when the rope is loose, it means that some living things have been lost due to human activity. That is when the environment loses sustainability. The more the losses, the bigger the problems.

☐ DVD 4 clip 2.4.1 Teaching activity: Educational Game Web of Life (13 min)



Picture 2 Ecosystem Copyright © Live & Learn

¹ From *Environmental Education Handbook, Teachers' Resource (Standard VI to VIII)*; Centre for Environment Education, 2005

Activity 3: Writing protective measures of biodiversity (5 minutes)

- Put the question on the blackboard: What should we do to protect biodiversity?
- Distribute blank paper to each student teacher and ask them to write their ideas.
- Ask student teachers to put their ideas on the blackboard.
- The teacher trainer summarises the opinions.

Extra activity 1: Video clip and discussion on the status of biodiversity

- ☐ Play the video clip “Natural resources conservation” (20 min) and ask student teachers to take notes focussing on the following questions: (DVD 1 clip 2.4.1)
 - 1) How many Great Mekong River countries are there?
 - 2) What are the advantages of forest for biodiversity?
 - 3) How does the wildlife and forest ensure a good environment?
 - 4) What has changed since 1990?
 - 5) What are the impacts of losing the forest to biodiversity and human development?
 - 6) What are the advantages of Cambodia Corridors for biodiversity?
 - 7) What....?

Extra activity 2: Video clip and discussion on the importance of protecting biodiversity

- ☐ Play the video clip “Protection and naming of vegetation” (8 min). Ask student teachers to take notes focussing on the following questions: (DVD 1 clip 2.4.1)
 - 1) What is the main topic of the clip?
 - 2) Why is classification of vegetation important?
 - 3) Why is it important to preserve the existence of plants and trees?
 - 4)?

2.4.2 Lesson 2 The Ecosystem and Wetlands

Activity 1: Draw an ecosystem picture (10 minutes)

Content book 2.2

- Distribute a few blank papers to each student teacher and ask them to draw a picture of a living and a non-living thing that are related to each other, at least 2 pictures per student teacher. (for example a dog and a bone or a cabbage and a watering can)
- Ask some student teachers to present their pictures and describe the relationship between the pictures.
- Ask student teachers to provide a definition of 'ecosystem'. The teacher trainer specifies: all the items in the pictures that have a relation with each other are called an ecosystem.
- The teacher trainer explains about the 2 kinds of ecosystems:
 - 1) Natural: Terrestrial and aquatic ecosystem. There are 2 kinds of aquatic ecosystem- Lentic, the ecosystem of a lake, pond or swamp, and Lotic, the ecosystem of a river, stream, waterfall or sea.
 - 2) Artificial: An ecosystem that is created by humans (e.g. zoo).


Activity 2: Writing exercise about good behaviour (10 minutes)

Content book 2.2

- Distribute a blank piece of paper to each pair of student teachers.
- Ask student teachers to compete in writing down as many activities as they can that are not harmful to the ecosystem for 1 minute.
- Ask student teachers to put the paper on the wall.

Activity 3: Observation of wetland map (20 minutes)

Content book 2.3

- Distribute a copy of the Outline Map to each pair of student teachers. (See Annex 2.4.2)
- Ask student teachers to observe and colour the wetland areas that they know.
- Then distribute the Wetland Map (See Annex 2.4.2) so they can check if what they found is right.
- Which pair of students knew the most areas?
-  The teacher trainer can show the slide of the wetland areas (Disc 3 folder 2.4.2) to check if all the areas have been identified.
- Brainstorming questions: What is wetland? How many wetland areas does Cambodia have? Where are they?
- The teacher trainer explains the balance between development and conservation.
- The teacher trainer explains more about the Ramsar Convention.
- The teacher trainer summarises the activity.

Chapter 3 Natural Resources and Impact of Overuse

3.1 Background information

The forest is vital for humans, animals and plants. It is very useful for both the environment and social economy. On the other hand, the forest also has a close relation with belief in the Buddha. Recently in Cambodia, the forest was seriously destroyed by illegal businesses. The loss of forest can cause flood, erosion, drought, increasing temperature, and migration etc. Therefore, people have to actively support and become involved in conserving forest and working on reforestation.

Wildlife is an important part of the natural environment. Nowadays wildlife is extremely threatened by human behaviour. The royal government has taken action to prevent further degradation of natural resources and is setting up many protected areas and wildlife sanctuaries.

Cambodia has a variety of mining resources which attracts many investors, but extracting the mine resources will affect the environment which is something that should be taken into consideration.

Global warming has affected humans, animals and plants. It is important to conserve and reforest the land in order to decrease the effects of global warming. Reforestation mitigates the effects of global warming because trees absorb carbon dioxide (CO₂).

3.2 Objectives

At the end of this chapter student teachers

Knowledge

- have learned to identify the categories of forest in Cambodia through the brainstorming questions and in writing the short story.
- have learned to list different species of animals correctly, especially the endangered species, through the game, classification, group discussion and brainstorming questions.
- understand the relation between the exploitation of natural resources and climate change, by reflecting upon the flash animation, newspapers and other articles.
- can identify Cambodia's main mining areas and describe the impact of running a mining business as discussed in the brainstorming question and case study.

Skills

- can identify the advantages of the forest for environmental conservation and the impact of cutting down trees as considered in the role play exercise.
- can discuss alternative possibilities for mineral resource exploitation which exhibit lower degrees of environmental impact, as discovered through the writing exercise.
- can discuss the effects of climate change on their local environment.

Attitude

- promote a love for the forest and wildlife.
- encourage others not to eat wildlife and promote this message to others.
- conserve electricity.
- conserve, protect, and advocate for natural resources in their own community.

3.3 Teaching aids

Lesson 1 Poem "Beauty of the forest" (see Annex 3.4.1).

Lesson 2 Copies of the story text (see activity), video clip "Community Based Eco Tourism in Chambok" DVD 1 clip 3.4.2 on DVD player/laptop or TV/projector.

Lesson 3 Endangered and abundant animal cards (activity 1) and story text “The regrets of a hunter” (activity 2) (see Annex 3.4.3) video clip “Wildlife conservation” on DVD.1 clip 3.4.3, DVD player/laptop or TV/projector, poster “Endangered Bird Species” and slideshow on Disc 3 folder 3.4.3.

Lesson 4 4 Case study (see Annex 3.4.4), video clip “Mining investment in Mondulkiri Province” on DVD 1 clip.3.4.4, DVD player/laptop or TV/projector.

Lesson 5 Flash animation “Climate Change” on Disc 3 folder 3.4.5, Laptop/computer and LCD projector, newspaper articles (see Annex 3.4.5), video clip “Global warming” on DVD 1 clip 3.4.5, poster “Causes of global warming”.

3.4 Teaching procedure

3.4.1 Lesson 1 Forest in Cambodia

Activity 1: Brainstorming question (5 minutes)

Content book 3.1 “A and B”

- The teacher trainer asks the following questions: What is forestry? How many kinds of forest are there and what are they? What are the positive aspects of the forest? Why is Cambodian forest disappearing?
Expected answer: Management of economic concession land is not good, population growth, lack of understanding of the benefits of the forest.



Picture 3 Forest in O Svay



Picture 4 Forest in Mondulkiri

Activity 2: Writing a short story (25 minutes)

- Divide student teachers into small groups.
- The teacher trainer asks student teachers to write a short story about the Cambodian forest based upon the answers of the brainstorming questions in activity 1 (Not more than one page).
- Each group representative reads their story.
- The teacher trainer finds and discusses educational points from the stories.
- The whole class decides which story is the best and explains why.

Activity 3: Poem “The beauty of the forest” (10 minutes)

- The teacher trainer writes the poem on the blackboard. (see Annex 3.4.1)
- Ask the student teachers to sing the poem together.
- Reflection questions: What does the poem talk about? Can you identify any of the trees? What should we do to protect and conserve the forest in our community? When is the Tree planting day (In Cambodia on the 1st of June) What does Arbor Day mean? (It is the name used in some countries like the USA for Tree Planting Day and it is celebrated on different dates throughout the world.)

3.4.2 Lesson 2 Deforestation

Activity 1: Group discussion on short story (15 minutes)

- Divide the student teachers into groups and then distribute the story to them.

I am Trongel mountain. 20 years ago, I was a beautiful green mountain. Since that time, the villagers have been cutting down trees, and they do not replant any. The streams and waterfalls that were near me have started to dry up. Animals that eat grass or green plants left because of lack of water, food and habitat. Sometimes I also cause danger to the local people when heavy rain falls on me. Some parts of my body fall down into the village, which can make them hurt. Only the local people can recover my beauty. Local people forgot the importance of the forest and that is why I became a useless place.

- Ask student teachers to read individually and then discuss the following questions as a group. Each group is asked to answer one question.
Questions:
 - 1) Why does the Trongel Mountain not have the amount of forest that it had 20 years ago?
 - 2) What will happen to humans and animals if there is no forest?
 - 3) In what way can we ensure the sustainability of timber forest collection?
Expected answer: Collecting the timber and non-timber forest production by seasonal calendar, reforestation and respect the forestry law of Cambodia.
 - 4) How can a village/commune chief motivate local people to be involved in reforestation?
- Each group presents their answers to their question, and others add more if necessary.
- The teacher trainer summarises the main conclusions of the discussion.

Activity 2: Play video clip and group discussion on forest conservation (15 minutes)

- Divide the student teachers into groups.
- Put the questions on the blackboard.
 - 1) What measures can be used to restore forest?
 - 2) What is community forestry? What are the benefits?
 - 3) What are the advantages of establishing natural resource conservation?
- ☐ Play the video clip “Community Based Eco-tourism at Chambok” on DVD 1 clip 3.4.2. (7 min)
- Ask each group to discuss on 1 question only.
- Each group representative shows their answer and others add more if it is necessary.

Activity 3: Short role play (10 minutes)

- Explain that the student teachers will do a role play on reforestation. During the role play they act like they are in a community meeting, finding alternative solutions to restore forest resources.
- Assign one of the following roles to around 15 students: commune chief, village chief, monk, villagers, and recently graduated university student. The meeting will be led by the commune chief.
All participants in the role play will get a chance to talk about problems or ideas related to the cutting or preservation of the forest.
- Ask the question: What did you learn from this role play?
- The teacher trainer adds more ideas and summarises main points of the lesson.
- ☐ **DVD 4 clip 3.4.2 Teaching activity: Role play on reforestation (16 min)**



Picture 5 Deforestation and Reforestation Copyright © Live & Learn

3.4.3 Lesson 3 Wildlife

Activity 1: Educational game “Endangered species” (10 minutes)

Content book 3.2

- What wildlife do you know? Can you recall the names of 12 birthday animals?
- The teacher trainer puts animal cards (see Annex 3.4.3) in a bag and walks around the class. Each student teacher picks a card one by one until the bag is empty.
- Student teachers form groups depending upon whether their card is red or yellow.
- Can student teachers identify the reason that some cards are red and some cards are yellow? Student teachers should compare the animals on their cards.

Expected answer: Animals on the red cards are Endangered Species and others on the yellow cards are called abundant species.

- 🎧 The teacher trainer shows the endangered bird species in Cambodia using slides on Disc 3 folder 3.4.3 and “Endangered Bird Species” poster

❑ DVD 4 clip 3.4.3 Teaching activity: Educational game Endangered Species (11 min)

Activity 2: Story analysing (20 minutes)

- The story (see Annex 3.4.3) is cut up into cards containing different paragraphs of the story. Distribute the story text to each group (1 or 2 paragraphs for each student teacher).
- Ask student teachers to read their texts individually and then exchange their information. Put all the paragraphs in the right order to reconstruct the story.
- One group representative reads and reports on their understanding of the story, others check.
- The teacher trainer concludes the lesson by asking the following questions if necessary:
 - 1) What ideas does the author want to show?
 - 2) In which phrase is it shown that the gibbon has feelings like a human?
 - 3) Why does Mr. Sok cry?
 - 4) How do you feel about the story?
 - 5) What... etc. ?

Activity 3: Video clip and discussion about Cambodian wildlife (15 minutes)

- ☐ Play the video clip “Wildlife conservation” (DVD 1 clip 3.4.3) (10 min)
- Student teachers watch and are asked to take notes.
- Ask questions like:
 - 1) Which wild animals are plentiful in Cambodia?
 - 2) Which wild animals are threatened?
 - 3) Which organizations are working on rescuing wildlife in Cambodia?
 - 4) What are organizations doing to conserve wildlife?
 - 5) What...?

3.4.4 Lesson 4 Mining resources

Activity 1: Brainstorming question (5 minutes)

- The teacher trainer asks questions like: How many Cambodian mine areas do we know? In which provinces can we find those mines? What are the products from those mines?

Activity 2: Case study (15 minutes)

- Divide the student teachers into groups and distribute the case studies for student teachers to read. (see Annex 3.4.4).
- Put this question on the blackboard: What is the negative impact of mining investments on the environment?
Expected answer: Pollution of the atmosphere, air, water and the soil, destruction of the forest, loss of animal habitat, and that it can cause climate change in that area.
- Put discussion questions on the blackboard:
 1. Where do problems in the case study happen?
 2. What are the causes of those problems?
 3. Who are the stakeholders in the case study?
 4. What are main problems that cause negative effects?
- Ask students to discuss the case study and find out solutions.
- Each group reports and the teacher trainer summarises the answer to each question.

Activity 3: Video clip and discussion (15 minutes)

- ☐ Play the video clip “Mining investment in Mondulkiri Province” on DVD 1 clip 3.4.4 (4 min).
- Student teachers watch and take notes.
- The teacher trainer asks the following questions:
 - 1) What is the video clip about?
 - 2) What problems are caused by mining investment in Cambodia?
 - 3) What is your opinion on those activities in the video clip?
 - 4) What...?

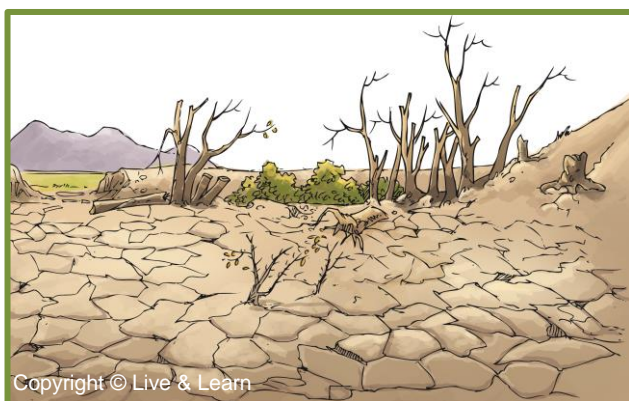
Activity 4: Sharing ideas related to activities linked to daily life (5 minutes)

- Ask the student teachers to share their own ideas on what we should do to ensure the sustainability and transparency on mining investment in Cambodia.
- They write their ideas on small pieces of paper and put it on the blackboard.
- The teacher trainer and student teachers work together to prioritize the top 3 ideas.

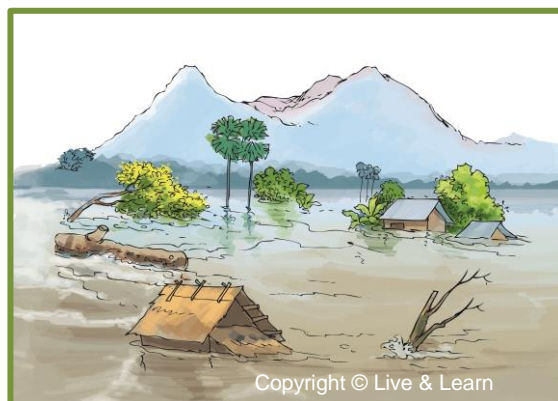
3.4.5 Lesson 5 Climate Change

Activity 1: Flash animation (10 minutes)

- Brainstorming question: What are examples of phenomena of climate change?
Expected answer: irregular seasons, more or less rain, flood, drought, changing water levels.
Why is global warming happening?
Expected answer:
Global warming is caused by the increased concentration of greenhouse gases in the atmosphere by using lots of equipment such as industrial and agricultural equipment.
- 🎧 Play the flash animation “Climate Change” (Disc 3 folder 3.4.5). A student teacher can come forward and help clicking on the different choices in the flash animation.
- The teacher trainer explains the relation between global warming and human activities (greenhouse effect) as shown in the flash animation.
- Hang up the poster “Causes of Global Warming”. Reflection questions at the end of the flash animation can be:
 - 1) What gases are harmful on the environment?
 - 2) Where do these gases come from?
Expected answer: The most common types of greenhouse effect made by humans are carbon dioxide and methane (from cow’s dung), nitrous oxide, CFCs (chlorofluorocarbons are used mostly in spray cans, refrigerators and air conditioners), but carbon dioxide is the most common.
 - 3) What is the relationship between global warming and climate change?
Expected answer: Global warming is the major reason for climate change, and it causes many problems such as flood, drought in some regions, changing rain patterns, giant waves, storms that may damage crops etc.



Picture 6 Drought



Picture 7 Flood

Activity 2: Group discussion (20 minutes)

Content book 3.4

- Divide student teachers into groups. Distribute a topic or a recent article from the newspaper and ask the student teachers to consider the meaning of the text. (See Annex 3.4.5 for examples)
Topic 1: The impact of climate change on humans and the environment
Topic 2: The causes of climate change
Topic 3: Methods of reduction of climate change
- Each group identifies the main problem in their article.
- The teacher trainer uses brainstorming questions to list human activities that cause climate change and discusses solutions.
 - 1) How does climate change affect our daily life?
 - 2) How can we respond to global warming?
 - 3) Which methods should we apply to reduce global warming?
 - 4) What...?

Activity 3: Sharing ideas related to daily activities (5 minutes)

- Ask student teachers to tell their own opinion on the climate change situation at their living places.
- The teacher trainer summarises the main points of the lesson.

Extra activity: Video clip on global warming

- ☐ Play the video clip “Global warming” on DVD 1 clip 3.4.5 (9 min).
- Student teachers watch and take notes.
- The teacher trainer asks questions like:
 - 1) What is the video clip about?
 - 2) What problems are raised?
 - 3) What are the causes of global warming?
 - 4) What can people do to prevent global warming and reduce the effects?

Chapter 4 Waste Management at PTTC/schools and community

4.1 Background information

Waste can be classified in different ways. Waste which decomposes quickly in the natural environment is called bio-degradable. Waste which is not decomposed by ordinary micro-organism activity is called non bio-degradable, and its decomposition will often take place over hundreds or sometimes thousands years.

There are 3 measures that can be applied to manage waste: reducing, re-use, and recycling.

Student teachers can get involved in promoting awareness on waste problems through preparation of a campaign. The campaign can be implemented at the Provincial Teacher Training Center or in the community.

Green clubs can be put in place in schools and these clubs can also be involved in the campaign.



Picture 8 Waste management in school

4.2 Objectives

At the end of this chapter student teachers

Knowledge

- can identify different kinds of waste and know how to classify waste as bio-degradable, non-bio-degradable or recyclable waste accurately, as they have learned through the poster and strategy discussion.
- can discuss the relation between the overuse of plastic bags and packaging and waste, as considered in the survey, group work and strategy discussion.
- can set the timeline for decomposition of kinds of waste through estimation and real experiment.

Skills

- can apply critical thinking and analysis skills to the problem of waste by relating waste items to lifestyle choices.
- can find solutions to reduce waste in their school/college.
- can develop and promote a waste management system which respects the 3Rs (Reducing, Re-use, Recycle).
- can analyse and look for alternative solutions which will reduce plastic bag use at school.

Attitude

- are motivated to contribute to reduction, re-use and recycling of waste.
- promote refusing the use of plastic bags as much as possible.

4.3 Teaching aids

Lesson 1 Live & Learn Poster “Polluted and Clean village”, Home and Community Waste Survey Sheet (see Annex 4.4.1)

Lesson 2 Home Garbage survey sheets (see lesson 1)

Lesson 3

Activity 1 banana peel, sheet of paper, dry leaves, flower, plastic bag, styrofoam cup/box, can, paper tissues, plastic spoon, mango peel, empty fruit juice pack, glass pot, piece of wood, toothpaste tube, 2 big table cloths to cover items

Activity 3 A few spades, Monitoring charts for Life Time activity (1 for each group of student teachers) (see Annex 4.4.3), calendar for the next 6 weeks – 2 months (depending on the time span during which you want to carry out the experiment).

Lesson 4 2 balls, protection gloves, sticks with pin or tongs to collect waste in the school compound, survey sheets for school waste audit (see Annex 4.4.4): 1 for each student, video clip “Waste - not waste” DVD 1 clip 4.4.4, DVD player/laptop and TV/projector

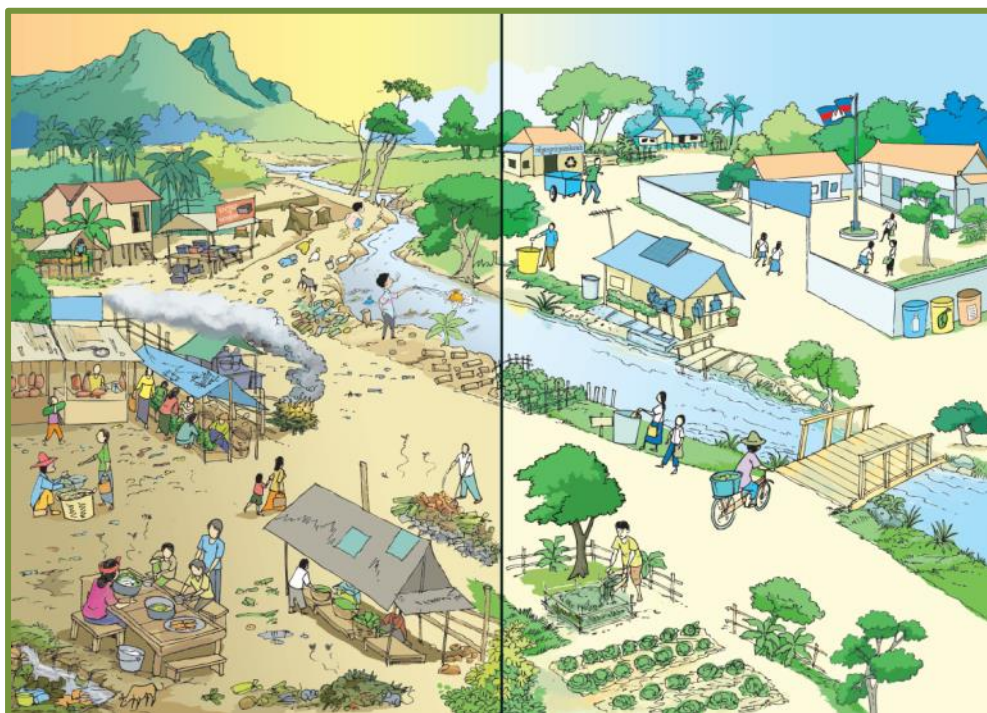
Lesson 5 Survey sheets for school waste audit (see previous lesson and Annex 4.4.4)

4.4 Teaching procedure

4.4.1 Lesson 1 Different kinds of waste and waste segregation

Activity 1: Discussion around poster “Polluted and Clean Village” (30 minutes)

- Ask the student teachers the following questions:
 - Guess the amount of waste you produce in your family or dormitory each day.
 - How do people in their village dispose of the waste they produce?
 - Do you think the applied ways of waste disposal are appropriate or not?
 - What kind of problems does the waste in their village cause?



Picture 9 Poster Polluted and Clean village Copyright © Live & Learn

- Discuss some common waste problems in Cambodia based on the Live & Learn poster (“polluted and clean village”). You can cover the “clean village” and discuss the “polluted village” first, and later uncover the clean village and continue the discussion. You can do this in a class discussion or divide the students into smaller groups.
- Some example questions for discussion on the “polluted village” poster:
 - o What polluting activities can you see in this picture? (*throwing waste into the river, waste is spread all over the village, food leftover from restaurants, waste from market, burning of waste, ...*)
 - o Which waste problems on the picture have you already seen in your own village?
 - o How is your own village different from the village on the picture?
 - o What is the negative impact of disposing of waste in the water sources?
 - o What is the negative impact of disposing of waste by burning it?
- Some example questions for discussion on the “clean village” poster:
 - o What are the differences to the other village?
 - o Which activities take place in this village that help to keep the village clean? (*Waste segregation, using organic waste for compost, waste bins in the village, waste is being recycled, ...*)
 - o Are there waste related activities taking place in this village that you have seen in your own village?
 - o Which village is most similar to your own village? Why?
 - o In which village would you prefer to live? Why?

Activity 2: Introduction of Survey (20 minutes)

- Explain to the student teachers that we want to investigate the real situation related to waste in their house and in their community. The student teachers will become ‘waste detectives’. In order to solve a problem you should first have a clear idea about the scope of the problem.
- Give the survey sheet to the students and divide the students in groups (See Annex 4.4.1):
 - a. half of the student teachers will do a home survey (or dormitory survey if they stay in the college)
 - b. half of the student teachers will do a community survey, if possible including a dump site in their community.
 Try to compile groups of student teachers that live close to each other (or stay in the dormitory, so that they can do a survey in the community around the college).
- Discuss with the students the location that each group would like to survey and assign a place to each group: make sure that there are no overlaps (e.g. specific market area, riverside, dump site, school compound, 1 specific street in the village, ...).
- If possible, ask students to go back to the site several times during that week.
- Have a look at the survey chart for the home survey and go through the questions for the community survey and make sure that all student teachers understand the task and the questions.
- Make practical arrangements for the survey task as homework and ask student teachers to carry out the survey for the next lesson (provide them at least 1 week to conduct the survey).

☐ **DVD 5 clip 4.4.1 Teaching activity: Group work on community and home survey (6 min)**

4.4.2 Lesson 2 Disadvantages of waste

Activity 1: Processing collected information and conclusion drawing (20 minutes)

- Ask the students for feedback about their experiences during the survey: Was it fun? Was it difficult? Were you surprised by what you found out? ...
- Divide students into groups: make sure that groups are compiled of student teachers who did the home survey and the students that did the community survey.
- Each group should discuss their findings (10 minutes) and make conclusions based on the questions below.
- In order to facilitate the discussion, you can provide the discussion questions on a slip of paper for each group, or write them on the blackboard:

Questions for Home Survey groups:

1. Which kind of waste seems to be most common in the homes/dormitory? Which kind of waste second most common?
2. Calculate the average amount of waste per week in 1 household.
3. What is the most common method of waste disposal at the home level?
4. Is the most common method of waste disposal also the best way?
5. Try to find a solution for each – discuss the best solution.

Questions for community survey groups:

1. Which kind of waste is most commonly seen on the sites? Which kind of waste was second most common?
2. Where is most waste coming from or who has thrown the waste there?
3. Try to find a solution for each problem – discuss the best solution
4. How can waste be reduced on the site?
5. How does waste disposal affect the community health?

Activity 2: Presenting conclusions and possible solutions (20 minutes)

- Ask each group to present their answers to the above questions and their conclusions.
- Discuss the suggested solutions for the problems with the whole class. Make sure that the conclusions and suggested solutions include the following (if not, try to lead the discussion into that direction): The conclusion should be that both at home level and community level, people will have to be more aware of waste problems, and that behaviour change for better waste management should be promoted.
- With these conclusions, you can introduce a waste management campaign (e.g. 3 R's campaign and/or waste segregation campaign) which can be carried out by the Green Club in your PTTC or by the class.

Homework idea

- Let student teachers reformulate the discussion questions to the level of students of grade 6
- Ask student teachers to make a lesson plan for primary school students based upon this activity



Picture 10 River pollution

4.4.3 Lesson 3 Bio-degradable and non-biodegradable waste

Activity 1: Educational game on differences of waste “Forget me not”² (15 minutes)

Content book 4.3

- Tell students that there are different kinds of items under the table cloth and that you will uncover them for 30 seconds. Make sure that all student teachers can see them (if necessary, ask them to stand around the table)
- Tell them that they have to try to remember as many as possible and that they have to divide the items they see into 2 categories (in 2 columns)
- Give them 1 or 2 minutes to write down the items in to categories (each student teacher individually, at their desk)
- Don't tell them in advance what the categories are- let student teachers try to find the categories themselves.
- When they're finished, ask student teachers to exchange their lists, so that others can evaluate the amount of remembered objects. Uncover the items, and let everyone compare them with the items in the lists. Let them write down the amount of correctly remembered items (even though they are not in the right columns). Who remembered all the items?
- Ask the student teachers about the categories that they chose: which criteria did they use to decide upon the 2 categories? Who chose the categories “bio-degradable” and “non-biodegradable”? (consider a choice of these 2 categories or “organic” and “non-organic” also as correct)
- Discussion:
 1. If necessary: introduce the terms “bio-degradable” and “non-biodegradable”
 2. What does “biodegradable” and “non-biodegradable” mean?
 3. How can we manage biodegradable and non-biodegradable waste? Which kind of waste is easy to manage? Why? (*biodegradable: can be used as compost, non-biodegradable waste: bury, recycle or re-use*)
 4. What are the main problems of non-biodegradable waste? (*not properly disposed, too much disposal, ...*)
 5. What are the main problems of improper management of biodegradable waste? (*bad smell, attraction of pests*)

DVD 5 clip 4.4.3 Teaching activity: Forget me not (18 min)

Activity 2: Experiment on biodegradable times of items

Content book 4.3

This activity can be done in the same lesson as Activity 3 or done separately depending on the available time.

- Introduce following items to the student teachers: banana peel, tree leaves, mango peel, small piece of wood, a paper bag, a plastic bag, tin can, glass pot, Styrofoam food box (polystyrene), milk or fruit juice carton
- Divide the student teachers into 10 groups (of 3, 4 or 5 students, depending on your amount of students) and assign 1 item to each group. Provide a monitoring chart to each group.
- Ask each group to mark the starting point onto the monitoring chart before burying the item (see Annex 4.4.3).
- Ask each group of students to dig a hole somewhere at the college compound which is 30 cm deep and ask them to bury their item and cover it up with soil. You can ask them to mark the place of their pit with a flag.
- You can also dig 1 large pit and spread the different items on the bottom of the pit.
- Each group has to check their item every week or every 2 weeks and record their findings on the monitoring chart (depending upon the total timespan during which you carry out the experiment: if only 1 month, ask student teachers to monitor every week, if 2 or 3 months: ask them to monitor every 2 weeks). Make a schedule or set a fixed time at which all groups should check their items for all groups (e.g. every Thursday afternoon at 5pm)

² From *Environmental Education Handbook, Teachers' Resource (Standard VI to VIII)*; Centre for Environment Education, 2005

- Ask the groups to bury the item again after digging it up each monitoring session.
- When back in the classroom: Ask students about their experience during the experiment: Was it fun? Could they follow the schedule? How many times did they monitor their item?

Activity 3: Life Time³ (20 minutes)

Content book 4.3

- Ask students to guess the time for decomposition of each object by standing on a time line. The timeline will make the differences between the decomposition of items more visible.
If you do not have time for the time line activity below, let them guess in the classroom, but use the following questions below to generate discussion afterward.
- For the time line: go outside and mark a distance of 100 meters as following: put a student every 10 meters. Explain that:
 - Every 10 metre represents a period of: 100.000 years
 - Every metre represents a period of 10.000 years
 - Every cm represents a period of 100 years
 - Every mm represents a period of 10 years
- Let students make a guess, and put their item on the time line.
- Give students information about degradation time of items and ask them to move on the right place of the time line.

Table of Life Span of Waste

Banana peel	3-4 weeks (should be confirmed after the experiment)
Tree leaves	2-3 weeks (should be confirmed after the experiment)
Mango peel	2-3 weeks (should be confirmed after the experiment)
Small piece of wood	10 years (even though degradation time takes more than 1 year, it is considered biodegradable (origins from plant))
Paper bag (or paper)	5 months
Plastic bag	1 million years
Tin can	80-100 years
Glass pot	Unknown – Eternity?
Styrofoam (polystyrene)	Unknown – Eternity?
Milk or fruit juice carton	5 years

- Ask students to compare the life span of a plastic bags compared to the other items. Discuss the alternative of burning plastic and also the consequences for health and air pollution.
- Brainstorming questions:
 1. What could be done with glass? (*can be recycled*)
 2. Discuss the problem of Styrofoam: who is using this packaging material, how many boxes do you receive a week when you buy food or snacks on the street? What is the average amount of Styrofoam boxes that are used in Cambodia (based on what they use in their family): make a guess. How many boxes per year are generated in Cambodia?
 3. What is the impact of burning of Styrofoam boxes? (*It makes them disappear, but the smoke is toxic and pollutes the air.*)
 4. Now that you know that Styrofoam boxes stay on the earth forever, and that burning them is dangerous for health and causes air pollution, can you think of a better option? (*Reducing: try to bring a re-usable food box that can be filled if you buy food, re-use Styrofoam boxes as much as possible,...*)

☐ DVD 5 clip 4.4.3 Teaching activity: Life Time (7 min)

³ From *Environmental Education Handbook, Teachers' Resource (Standard VI to VIII)*; Centre for Environment Education, 2005

Extra Activity: Conclusion

This can be done in another lesson after between 1,5 and 2 months

- Ask students to dig up their items and bring them to the class room (they might need a container to put it in).
- Ask students about their experience during the experiment: was it fun? Could they follow the schedule, how many times did they monitor their item?
- Ask students to observe their item and make a general evaluation and conclusion on the chart.
- Let each group present their conclusion and show their item to the other groups.
- Compare items with the following questions:
 1. Which items changed, which didn't?
 2. How did the items change?
 3. The items can be categorized into 2 groups what are they? (*bio-degradable and non-biodegradable waste: note that all the non-bio-degradable waste will be relatively unchanged, e.g. plastic bags, bottles, etc.*)

4.4.4 Lesson 4 The 3R'S: Reducing, Reusing and Recycling

Activity 1: Introduction game (10 minutes)

Content book 4.4

- Ask student teachers to make 2 circles- play the game in 2 groups (2 circles).
- Give 1 student from each group the ball to start.
- He/she has to say the name of a waste product (e.g. banana peel, plastic bag, aluminium wrapper of sweet, ...), and after saying that name, he/she throws the ball to another student teacher. The student teacher who catches the ball has to say if that waste item can be reused or recycled and how, or if not, that it should be reduced. He/she throws the ball to another student who immediately says another waste product and throws the ball to another student who has to assign 1 of the 3 R's again. Continue until all students received the ball once. Tell the students to throw the ball to a student who didn't receive the ball yet.

Activity 2: School Waste Audit (30 minutes)

- Divide the students into groups and let them walk around inside the college compound. You can assign a specific route to each group (e.g. by providing a map of the school compound (made by yourself or the student teachers) on which each group has to draw their route)
- Let them write down and describe or collect (with protection gloves and a stick with pin or tongs, in order to pick up the waste safely) all the solid waste that they see, let them make a list of organic waste they see (don't ask them to bring it back to the class room).
- Collect the items (or the lists in the class room) and ask the student teachers to work in the same groups and to place all the items into 3 categories: "waste that can be recycled"; "waste that can be reused"; and "remaining waste".
- Discuss with students: how can the recyclable items be recycled? (Waste collectors they bring it to collection places for export), do you know in which products they can be recycled?



Picture 11 Teaching aids made of waste

☐ DVD 5 clip 4.4.4 Teaching activity: school waste audit (7 min)

Activity 3: Instruction on survey (10 minutes)

- Play the video clip on recycling “Waste - Not waste” DVD 1 clip 4.4.4 (7 min)
- The teacher trainer and student teachers reflect on school waste audit and content of video clip.
The teacher trainer explains that we have 3Rs meaning “Reducing, Re-using and Recycling” and explains that we should properly dispose and segregate the waste by type of waste bins, for example, paper should dispose into the bin that store reusable waste, and the easy bio-degradable waste can be used to make compost fertilizer.
- The teacher trainer distributes the survey sheet to each student teacher for individual homework (see Annex 4.4.4)

In the Teacher Training Centers and schools it is advised to apply the following ways to segregate waste:

Green bin: Organic waste, like leaves, weeds, dead plants, other rubbish from the garden

Yellow bin: waste that can be recycled, like plastic bottles, cans

Orange or red bin: Waste that should be reduced (waste that does not belong in the other 2 bins).

4.4.5 Lesson 5 Survey on plastic bag use in the school ⁴

Activity 1: Group work on survey individual plastic bag use (15 minutes)

Content 4.5

- Ask the student teachers to sit in groups and analyse the data they collected from the survey sheet from last week (see Annex 4.4.4). Put questions on the blackboard for students to discuss.
 1. What are the main purposes your group uses plastic bags for?
 2. How many of your group bring plastic bags to school?
 3. Which are the most common things brought to school in a plastic bag?
 4. How many plastic bags do you throw away in a day in your group?
 5. How many student teachers in your group take a shopping bag or reuse a plastic bag when shopping?

Activity 2: Result analysis (25 min)

- Collect the results from each group together and analyse the results from the whole class. Discuss questions like:
 1. How many plastic bags are thrown away in your class per day?
 2. Calculate the average amount of plastic bags thrown away by all classes in your college? In a day, a month, a year?
 3. What is the impact of all these plastic bags on the environment? How should we get rid of all these bags? (Discuss the options: *burning (toxic, chemical smoke is released)* or *burying: it takes up to 1 million years to disappear from the earth...*)
 4. How many student teachers in your class re-use plastic bags or use a shopping bag or basket for shopping?
 5. Which are the most common things in your class being brought to school in a plastic bag?
 6. Is there another way to bring these things to school? What are the alternatives?
 7. How can the class reduce the amount of plastic bags?

⁴ From *Environmental Education Handbook, Teachers' Resource (Standard VI to VIII)*; Centre for Environment Education, 2005

4.4.6 Extra activity: Educational Game “Use & Throw”⁵

Teaching aids

- 2 baskets: 1 with text “20-30 years ago”, 1 with text “Now”.
- 2 big bags.
- blind folds (1 for each student teacher, you can ask student teachers in the previous lesson to bring a blind fold).
- Objects for the game (see list below) :

Banana leaf basket for packaging food	Styrofoam food box
Ceramic bottle	Plastic drinking bottle
Drinking glass / ceramic drinking cup	Styrofoam or plastic cup
Wooden toy (or toy made from other natural materials)	Plastic toy
Oil lamp or candle	Light bulb
Piece of sugar cane	Plastic tooth brush
Cloth bag or rattan basket	Plastic bag
Homemade sweet in banana leaf	Chocolate or sweet with plastic wrapper
	Battery
Cotton cloth	Synthetic cloth
Wooden broom with twigs	Plastic broom

Activity 1: Educational game about packaging materials “Use and Throw” (20 min)

- Put the materials mentioned above (mixed up) into 2 different bags.
- Divide the student teachers into 2 teams. All student teachers should be blind folded, except for 1 student teacher per team
- Place the 2 baskets labelled “20-30 years ago” and “Now” in the classroom.
- The blind folded students are to take an object out of the bag, and try to identify it by feeling. Based on feeling the object (the material and the shape) they have to decide whether the object is mainly used 20 to 30 years ago or now, and throw it into the right basket. If you have a big class, ask student teachers to identify 1 object per 2 or 3 student teachers (in order to involve all student teachers in the activity). Let student teachers feel the object one by one, and let them discuss to identify the object and decide in which basket it should be put.
- The student teacher that is not blind folded has to guide the blind folded student teachers to the right basket BUT he/she is not allowed to help (not to tell the name of the object, nor in which basket the object should be thrown).

Activity 2: Discussion and reflection on the use of packing materials (20 min)

- Ask all student teachers to remove their blind folds.
- Take all the objects out of the baskets. With the class, check if the objects were placed into the correct basket.

⁵ From *Environmental Education Handbook, Teachers’ Resource (Standard VI to VIII)*; Centre for Environment Education, 2005

- Reflect on the activity by using following questions:
 1. What is the biggest difference between objects from 20 years ago and objects used now (possible answers: 20 years ago, more natural materials were used, more bio-degradable materials, some materials can be re-used more easily than some more modern materials (ceramic pot vs. plastic bottle, ceramic/glass cup vs. plastic cup...))
 2. Why did we change the kind of objects that are used? (as a consequence of modernization and industrialization (industrial production of packaging and other materials, materials are stronger, look nicer, and can be bought easily (no time need be spent making it), people like to use “modern materials” (like to show that they can afford it,...))
 3. What are the consequences for the environment of using new kinds of materials? (Increase of waste generation, less bio-degradable waste, production of modern materials (e.g., plastic) increases carbon emissions in the atmosphere,...)
 4. How can these problems be solved? (By promotion of re-using materials and using more bio-degradable (packaging) materials,...)

☐ DVD 5 clip 4.4.6 Teaching activity: Educational game Use and Throw (5 min)

4.4.7 Extra activity Campaign on a plastic bag and packaging free school⁶

Teaching aids

- Different sets of (at least 3) different waste bins in different colours (preferable: green, yellow and red/ orange)
- Logo's, drawings, slogans for communication about the waste management system and a plastic bag free school

With the student teachers form “Green Clubs” with the support and lead of the teacher trainers. Install slogans and billboards around PTTC in order to educate about waste management and caring for the environment.

Every new school year ask for ideas from the student teachers how the Green Club can be more effective at reducing plastic bag use in PTTCs and schools. A group of student teachers (i.e. The “Green Club”) should collect all plastic bags in the school, one time per week, in the afternoon. All the plastic bags from the whole week are exposed on a visible place in the compound to help the students to realise how many bags they use.

Other possible campaign ideas include: promote the use of a re-usable food box; don't accept plastic bags from the shop if you don't need them; bring your own re-usable bag everywhere, and so on.

Students can make slogans and put them up around the school grounds to encourage students to use less plastic bags and packaging.

☐ DVD 5 clip 4.4.5 Teaching activity: A plastic bag free school (8 min)

⁶ From *Environmental Education Handbook, Teachers' Resource (Standard VI to VIII)*; Centre for Environment Education, 2005

4.4.8 Extra activity Campaign to reduce plastic bags in the community

Teaching aids

- Provide material that will be used in the campaign: flipchart, markers, pen, internet + printer and information board.

Ask students to develop and carry out a promotional campaign in the community on reducing the use of plastic bags. The teacher trainer should ask different groups of student teachers to develop their own campaign.



Picture 12 School waste campaign in the community

Following tasks can be assigned to one or more groups:

1. Make people aware of the extent of their use of plastic bags (e.g. by making an artwork of all the plastic bags that is average used by 1 Cambodian per week, making a poem or song about all the places where a plastic bag is collected during 1 day/week, develop slogans, use photos of plastic bags on the roadside,...)
2. Make people aware of the alternatives or the solutions to reduce plastic bag: refusing plastic bags, taking your own shopping bag to the market, promote the re-use of plastic bags,... (e.g. by slogans, songs, pictures, a short theatre play that can be done at the market.
3. Convince sellers at the market that they can contribute to the environment by creating awareness amongst their customers (e.g. by information flyers / brochures, posters that they can hang at their stall, make a song that you sing walking around the market,...)

☐ DVD 1 clip 4.4.8: Video clip on waste campaign in the community (5 min)

Chapter 5 Pollution in Cambodia

5.1 Background

Pollution is the contamination of the earth's environment with materials that interfere with human health, the quality of life, and natural functioning of living things and their surroundings. Although some environmental pollution is a result of natural causes, most of it is caused by human activities.

Although there have always been pollution problems, the greatest threat to man's environment came with the beginning of the industrial revolution. Factories multiplied upon the face of the earth and later the automobile was invented. Mankind is greatly indebted to industry (what would our modern world be like without it?), but it did carry with it some serious pollution problems.

Not unlike the rest of the world, Cambodia faces serious environmental problems. The main problems include air pollution, waste disposal and water pollution as a result of population growth and urbanization.

5.2 Objectives

At the end of this chapter student teachers

Knowledge

- know the root causes of air pollution and its impact by watching the flash animation, taking part in the partner finding game and debate activity.
- can list options for disposing of waste as discussed in the waste disposal game, the strategic questions and reflecting questions after playing the game.
- can accurately discuss the importance of water for people, animals and plants.
- can explain positive and negative habits of community life for people who live along the stream, which they learned in the discussion about the posters and follow up questions from the teacher trainer.
- can estimate the available quantity of useable water and relate that to the water cycle, as discussed in the group work activity and the water cycle experiment.
- can talk about the consequences of the consumption of unsafe water and arsenic water, as was discussed through strategic questions, song, the water source finding game, and in the video clips.

Skills

- always use waste bins and correctly dispose of waste.
- can devise solutions to the plastic bag problem in their community.
- can install and use a ceramic water filter correctly.
- can identify and explain the way that water is purified in nature (water cycle) as discussed in the water cycle experiment.

Attitude

- are willing to change any negative attitude that can cause atmosphere pollution.
- change from bad attitude of disposing waste to good attitude.
- change to stop burning waste and stop disposing waste at public places.
- involve in promoting hygiene education and clean water consumption at rural areas of Cambodia.

5.3 Teaching aids

Lesson 1 Video clip on "Air and noise pollution" DVD 2 clip 5.4.1, video clip "Air pollution" DVD 2 clip 5.4.1, DVD player/laptop or TV/projector and Word cards for finding partner game (see Annex 5.4.1)

Lesson 2 Situation cards: 1 card per 2 student teachers (1 set = 6 cards) and sheets with different solutions (9 sheets to hang on the walls in the class room) (see Annex 5.4.2)

Lesson 3 Cards with names of different kinds of waste – 1 set of cards for each group (e.g. 40 student teachers, 8 groups of 5 student teachers: you need 8 sets of all cards). (see Annex 5.4.3), 9 Name cards of places for common rubbish disposal (see Annex 5.4.3), 9 Baskets (or boxes) representing common places for waste disposal in Cambodia

Lesson 4 Video clip on “Plastic bags used in Cambodia” DVD 2 clip 5.4.4, DVD player/laptop or TV/projector, Role play cards: 1 set = 8 cards (see Annex 5.4.4).

Lesson 5 Live & Learn poster - “Polluted River”, 12 small cards (pictures extracted from the poster), ceramic water filter, video clip on “Use of ceramic water filter” DVD 2 clip 5.4.5, DVD player/laptop or TV/projector

Lesson 6 Live & Learn poster “Polluted River and Clean River”+ cover (to cover up the clean river), A4 page with “Agree” and another with “Disagree”, paper and drawing materials for student teachers, video clip “Clean drinking water” DVD 2 clip 5.4.6 , DVD player/laptop or TV/projector

Lesson 7 Outdoor play field, chalk or rope to mark lines, diagram on flip chart or blackboard, examples of observation charts and questionnaire (see Annex 5.4.7), note books

Lesson 8 Video clip “Water Consumption” DVD 2 clip 5.4.8, DVD player/laptop or TV/projector

Lesson 9

Activity 1: 2 buckets (1 empty and one with at least 3 litres of water, or more), measuring cup (if not available: empty small water bottle), 1 teaspoon (small spoon), 5 transparent containers (empty bottles of water, cut in half) or glasses, ink-dropper or pipette

Activity 2: Poster “Water Cycle”, PowerPoint of the Water Cycle (Disc 3 folder 5.4.9), laptop/computer and LCD screen,
materials for Water Cycle Experiment: different bowls with boiling water (depending upon the amount of groups that carry out the experiment) or cooking pot and cooking set for boiling water, glasses or ceramic bowls to put inside the cooking pot or big bowl, plastic foil (a role), ice cubes, salt, polluting materials: cheap perfume, food colouring powder, detergent (soap), kitchen oil, ink, ..., rubber gloves

Lesson 10

Activity 1: Song lyric “Safer Water” on flipchart

Activity 2: Cards of water sources (Clean and polluted) and water use cards (see Annex 5.4.10),

Activity 3: Video clip “Arsenic Water Consumption” (DVD 2 clip 5.4.10), DVD player/laptop or TV/projector

5.4 Teaching procedure

5.4.1 Lesson 1 Air pollution

Activity 1: Watch and discuss video clip on air and noise pollution (10 minutes)

Content 5.1 “A” and “B”

- ☐ Play the video clip “Air and noise Pollution” (DVD 2 clip 5.4.1) (8 min)
 - Brainstorming questions:
 - 1) What is the main problem in the video clip?
 - 2) What are the causes of the problem?
 - 3) Do you know any good solutions?

Activity 2: Finding partner game (15 minutes)

- Distribute a word card to each student teacher (see Annex 5.4.1). Each student teacher receives a card which describes either a cause (grey card) or effect (white card) of a type of air pollution.
- Ask student teachers to try to find a partner whose card has a cause or effect which corresponds to their own card.
- Each pair of students describes their cards and the relation between them.
- The teacher trainer corrects the wrong matching of the cards if necessary.
- The teacher trainer asks: can the effects on the white cards also be causes by other problems?
If yes, which ones?

☐ **DVD 6 clip 5.4.1 Teaching activity: Finding partner game (15 min)**

Activity 3: Debating on advantages and disadvantages of the public transportation (15 minutes)

Content 5.1 “C”

- ☐ Show a short clip “Air pollution” (DVD 2 clip 5.4.1) (2 min)
- Divide the student teachers into 2 groups.
- Ask the first group to identify advantages and the second group to identify disadvantages of developing public transportation in Cambodia.
- Have a representative from each group present their ideas.
- As a class debate the 3 best ideas for public transport in the Cambodian context.
- The teacher trainer summarises the main points of the lesson and gives more information about air pollution in Cambodia.

5.4.2 Lesson 2 Waste disposal in Cambodia

Activity 1: Discussion on solutions for waste problems (40 minutes)

Content book 5.1 “D”

- Display the different solution cards around the classroom. Hand out 1 situation card to each pair of student teachers. (Both in Annex 5.4.2).
- Ask each pair of student teachers to read the situation card carefully.
- Ask them to walk around in the classroom and read the different options they have.
- Let the pairs discuss their options and ask them to choose the best solution, taking into account their personal interest and that of the environment. Ask them to stand next to the solution that they chose.
- Ask questions:
 - 1) Why did you choose this?
 - 2) Who has the same situation cards? What did you decide and why?
 - 3) How would you solve the problem on the situation card?
 - 4) In what way are other people involved in the solution to that situation?
 - 5) What are other solutions? Do you want to change your decision, and if so, to which one and why?
- Ask student teachers to describe and explain the reason one by one.
- The teacher trainer summarises the information on waste management.

☐ **DVD 6 clip 5.4.2 Teaching activity: Making waste decisions (13 min)**



Picture 13 Segregating waste

5.4.3 Lesson 3 Educational Game on Waste Disposal

Activity 1: Game on waste disposal (15 minutes)

- Prepare 9 baskets/buckets by sticking the name cards of the locations for rubbish disposal as listed in Annex 5.4.3. Put the 9 baskets in different places in or outside of the classroom.
- Divide the student teachers into 5 groups.
- Give all groups a set of picture cards showing rubbish item cards as listed in Annex 5.4.3 (a whole set of cards for each group), or provide real rubbish items.
- Instructions of the game:
 1. Discuss where members of the local community normally dispose of this rubbish.
 2. Each group has to put their cards into the basket of their choice. Make clear that they have to think about the most common place, based on their experience from seeing waste at home or in their community, NOT based on what they believe it's the right place.

Activity 2: Evaluation of the game on waste disposal (25 minutes)

Content 5.1

- Count the amount of cards in each basket and check which place the student teachers think is the most common for waste disposal. Check also what kinds of materials they put into each basket.
- Ask the student teachers
 1. What are the most common places of waste disposal in Cambodia? And why?
 2. What should people do with biodegradable waste?
 3. What should people do with plastic bags?
 4. What should people do with old batteries?
 5. If people don't understand clearly about the management of waste, what can we do to teach them?

Expected answers:

1. In Cambodia, people dispose the waste along the road, public places and into lake, river, and stream because they do not understand the impact of it.

2. Bio-degradable waste should dispose in compost pit to avoid bad smell and losing its advantages.
3. Plastic waste should reuse or sell it to recycling shop.
4. Battery waste should dispose into safe box or keep it separately then bury it.
5. Promote awareness on disadvantages and advantages of waste in schools and community, focus on sustainable and useful waste management in school and community, organizing a campaign, make as brochures and involve local radio and television.

☐ **DVD 6 clip 5.4.3 Teaching activity: Educational game Waste disposal (12 min)**

5.4.4 Lesson 4 Plastic bag problem in our village

Activity 1: Video clip and discussion on plastic bags problem (15 minutes)

- ☐ As an introduction to the topic show the video clip “Plastic bags used in Cambodia” DVD 2 clip 5.4.4 (2 min)
- Brainstorming questions after watching the video clip:
 1. What is the problem in this video clip?
 2. Why is it a problem?
 3. How many plastic bags do you generate per week?
 4. Do you do something to try to reduce it?

Activity 2: Role play on solutions for the problem of plastic bags (15 minutes)

- Divide the students into groups of 8 (or more) students. Each group gets 1 set of role play cards and if a group has more than 8 members you’ll have to add one more person into the story, for example, an extra villager. (see Annex 5.4.4)
- Explain that each group represents the participants of a village meeting during which the problem of plastic bag pollution in the village is being discussed. The aim of the meeting is to discuss the problem of plastic bags in the village and to find a solution for that problem.
- Student teachers read and prepare for their role. They should try to imagine themselves in the situation of the role they will play during the meeting.
- Explain the role of the village chief for all groups together. The village chief (1 of the roles) guides the discussion and decision making process. He makes sure that all the participants of the meeting have the chance to give their opinion and ideas. At the end of the meeting, the discussion should result in a conclusion and decision for the future. It is the role of the village chief to guide the discussion to try to arrive at a conclusion upon which everyone can agree.
- The village leader begins the role play.

Activity 3: Conclusion of role play (10 minutes)

Content 5.2 B

- At the end of the meeting each village chief presents the solutions that were chosen to solve the problem of plastic bags in their village. The teacher trainer should note each solution on the blackboard.
- The different suggested solutions are compared: are they similar? What are the differences? Which one is the best solution to solve the problem? Which one is most realistic?
- The proposed solutions can be the basis for a real campaign to reduce the use of plastic bags around the PTTC or in the community around the school.

5.4.5 Lesson 5 The importance of water

Activity 1: Starting activity: Performing art: “The Water and I” (10 minutes)

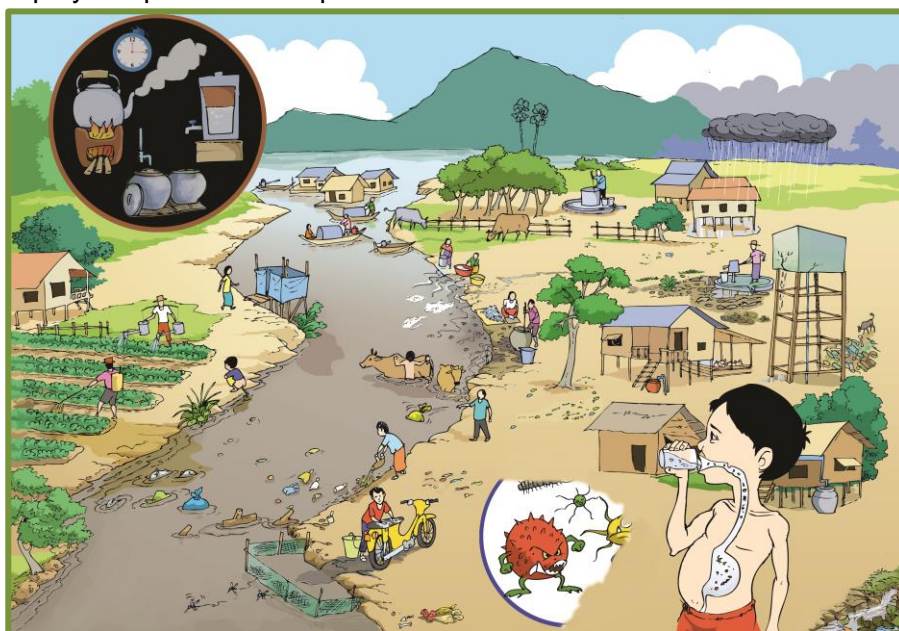
- The student teachers sit in a circle (If possible you can do the activity outside at a place where they can sit.)

- Ask the student teachers to perform an activity in their daily routine which requires the use of water, for example, cleaning teeth, bathing, washing clothes, watering plants, etc. They can only mime, not speak. Other students have to guess which activity they are showing.
- Discuss with student teachers: Do these activities cause water pollution? How? If it has a negative impact, how can it be avoided or reduced?

❑ DVD 6 clip 5.4.5 Teaching activity: The Water and I (7 min)

Activity 2: Group discussion and class discussion on Poster "Polluted River" (20 minutes) Content 5.2 A+B

- Divide the 12 cards (Picture cards in the life skills box showing small parts of the poster) among the student teachers: form groups of 3 or 4 students for each card. (Do NOT hang up the poster yet.)
- Ask the student teachers to discuss within their group the following questions:
 1. Describe the activity on the card.
 2. Evaluate the activity on the card with regard to impact on environment and health.
- Ask one representative of each group to explain their activity and their evaluation of the activity.
- Then display the polluted river poster.



Picture 14 Poster polluted river Copyright © Live & Learn

- Ask each group to match the activity on their card with the poster and let them discuss the activity again: Would you evaluate the impact of the activity on the small card in a different way now that you can see the larger context in which the activity occurs? Why? What changed?
- Class discussion: evaluate the poster and discuss all the activities that cause water pollution. The discussion should include following issues:
 1. Throwing garbage in the river.
 2. Garbage close to water sources (after rain, water run off can cause ground water pollution and river pollution).
 3. Human activities that pollute close to water sources: use of chemical pesticides (can both pollute ground water and as run off into the river), washing clothes in the river, use of the river as a toilet, washing animals in the river, washing a motorbike in the river, cleaning fish and making prahok next to the river, ...
 4. Discuss the consequences for human health: eating fish from a polluted river, drinking polluted water from ground water sources, river,...

- Discuss the different options for how water can be purified (ground water, rain water), and brainstorm for more options with the student teachers:
 - Boiling of water (at least 15 minutes)
 - Using a ceramic water filter

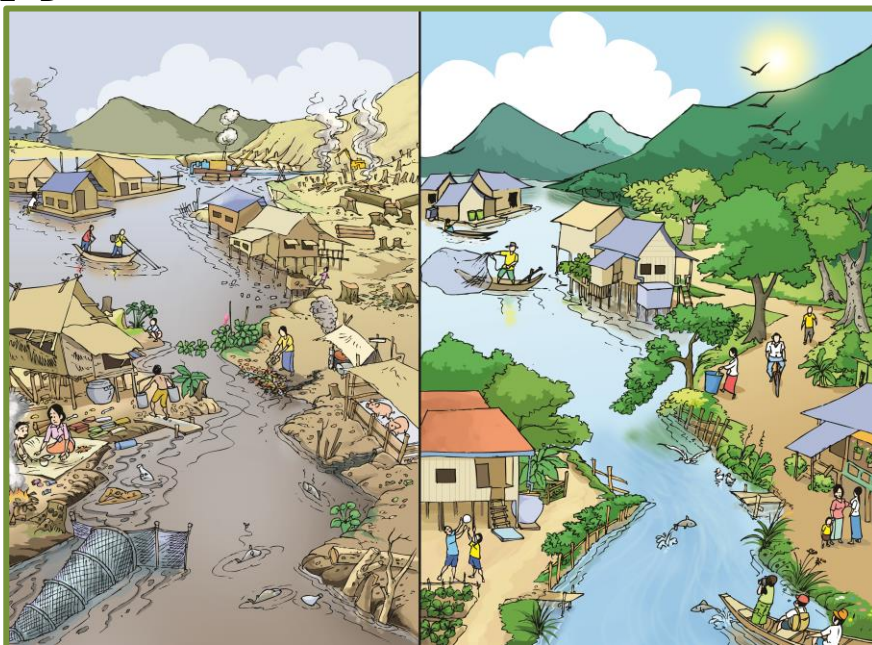
☐ **DVD 6 clip 5.4.5 Teaching activity: Group discussion on polluted river poster (9 min)**

Activity 3: Practice the use of a ceramic water filter (10 minutes)

- ☐ Play the video clip “Use of ceramic water filters” on DVD 2 clip 5.4.5. (3 min)
- Practice the use of ceramic water filter in groups. Provide 1 filter per 4-5 student teachers.
- Show how to install the water filter by using the instruction notes in the water filter box.
- Ask each group to practice installing it and discuss the advantages.
- Each group reports their findings and the teacher trainer summarises the main points of the lesson.

5.4.6 Lesson 6 Polluted and Clean River

Activity 1: Discussion of poster “Polluted and Clean River” (25 minutes)
Content 5.2 “D”



Picture 15 Polluted and Clean River Poster Copyright © Live & Learn

- Start the activity with the picture on the right (clean river) covered.
- Discuss the picture of the polluted river with the following questions:
 1. What are the sources of pollution in this picture?
 2. What other environmental problems can you see in the picture?
 3. What is the impact of polluted water to the people who live in this village?
 4. Why do you think the people in this picture look very unhealthy?
 5. Do you recognize situations like this? Compare situations in the picture with situations you have seen in your own village.
- Show the picture of the clean village and ask questions such as:
 1. What are the similarities and what is different?
 2. How can people make their village clean?
 3. Why is there no waste near the river?
 4.

☐ **DVD 6 clip 5.4.6 Teaching activity: How to use Polluted and Clean River poster (12 min)**

Activity 2: Debate about who is responsible for water pollution? (15 minutes)

- Show video clip: cartoon “Clean drinking water” on DVD 2 clip 5.4.6 (3 min).
- Write the following statement on the blackboard: “The local authorities are responsible for finding the solution to the problem of pollution of our rivers”.
- Stick the words “Agree” and “Disagree” on two sides of the classroom.
- Ask students whether they agree with the statement on the board. Ask them to stand near the word (i.e. “agree”, “disagree”) that corresponds with their opinion.
- Ask students to give their arguments as to why they agree or disagree. If possible, try to summarise the arguments on the blackboard (in 2 columns: agree and disagree). Discuss if the explanations are reasonable.
- The teacher trainer concludes that cleaning is our responsibility and that the local authority has power and responsibility to encourage people to be involved in cleaning through measures such as education, administration, fining, etc.

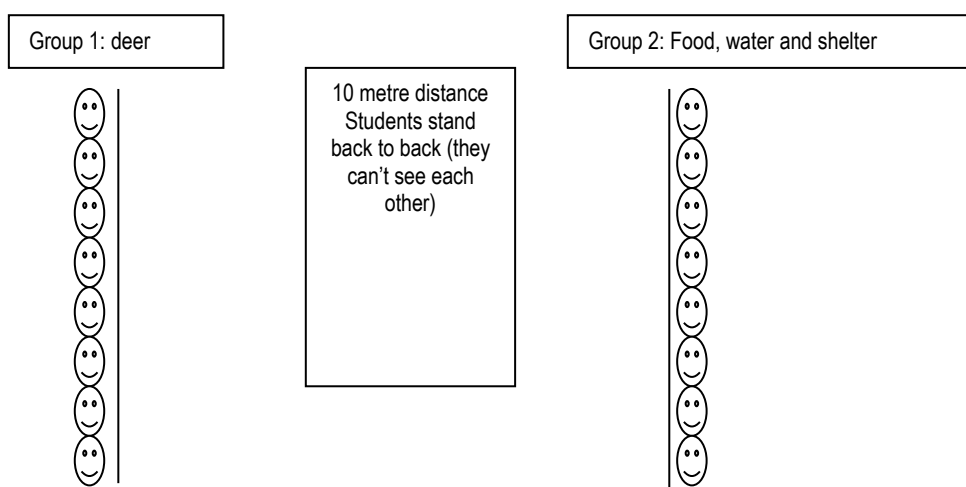
5.4.7 Lesson 7 Preparation on water sources survey

Activity 1: Educational game on importance of water “Oh Deer”⁷ (20 minutes) Content book 5.2 “A”

- Go outside to the playground.
- Divide the student teachers into 2 groups. Explain that 1 group of student teachers are deer and the other group are components of the habitat of the deer. Tell the players that the essential components of a habitat are food, shelter and water. Explain that deer need good habitat to survive.
- In each round of the game each student teacher chooses one aspect of habitat – food, water, or shelter- and must make the hand symbol which represents that habitat (shown below) until the end of that round.



- The activity starts with all players lined up behind their respective lines (see below), deer on one side, and the habitat components on the other. The ‘deer’ and the ‘habitat components’ should not face each other. Instead they should stand with their backs to each other.



⁷ From Green Games; Centre for Environment Education, 2006

- Begin each round of the game by asking all the players to randomly and secretly choose one of the 3 symbols and to show their symbol with their hands. Each player (both deer and habitat) has to choose one of the 3 symbols for food, shelter or water.
- If the deer is making the 'water' symbol it means it needs water. Making the 'shelter' symbol means it means shelter, and so on. The habitat players also choose 1 of the 3 symbols of their choice. Players may choose a new symbol each round.
- At the count of three or at a whistle or clap, the deer must run towards the habitat line, try to find the component it needs (water, food or shelter) and then stand in front of that person. Each deer should continue to display the hand signal indicating the desired component while it is searching. Only one deer is allowed to occupy each available habitat component.
- Each deer that located the correct habitat component survived, and can go back to the deer line. Any deer that couldn't find the right habitat (e.g. there were more deer looking for food than there was food available on the habitat line) has died, and they become part of the habitat group during the next round.
- Play the game like this for 2 or 3 more rounds.
- At the 3rd or 4th round the rules change: but you only tell this to the habitat group (not to the deer). Tell the habitat group that for the next round, they must choose shelter because there is a drought: food and water are unavailable. Every habitat player must choose the symbol for shelter.
- The deer are still unaware of this rule change: so some will be thirsty, others will be hungry, and others will be looking for shelter. As they will find only shelter, all the deer that were looking for food and water will die. How many?
- Go back to the classroom for discussion.

Discussion in the classroom:

- How many deer died in the first round and why?
Expected answer: This is what happens in nature everyday: not enough resources for all, survival of the fittest.
- How many deer died in the last round and why?
Expected answer: Much more than in the previous round. Only shelter was available.
- Why might there have been no water or food?
Expected answer: No rain, water sources dried up or polluted,...
- If there is a drought, why is there no food either?
Expected answer: Deer eat plants or grass and plants need water too. If there is a drought, there is no food for the deer either.
- What happens with humans if there is no water available? Conclusion: for who or what is water important?

❏ DVD 7 clip 5.4.7 Teaching activity: Educational game Oh deer (15 min)

Activity 2: Preparation for water sources quality survey in the village (20 minutes)

- Brainstorming question: What is the water source situation of your village?
- Make groups (choose student teachers who live close to each other, or who can do the survey in the same area / community) and ask them to make a questionnaire and an observation sheet for the survey to be carried out within the next 1 or 2 weeks. The teacher trainer should check the questionnaire and observation sheet, and make sure it will provide the required information. Examples of an observation chart and a questionnaire can be found in Annex 5.4.7.
- The teacher trainer gives some tips to the groups:
 1. Identify all water sources in the area/community of survey. Draw a map of this area and mark the water sources on the map.
 2. Observe each water source and complete 1 observation chart for each water source observed.
 3. Interview at least 2 people per water source (living close and/or using the water source) using the questions of the questionnaire.

4. (if possible...) Ask student teachers to take photos of the water sources and their surroundings (with a camera or their mobile phones).
5. Colour the water sources on the map as following (based on the gathered information by the survey):
 - Green: Colour a water source green when the water source and its immediate environment are clean.
 - Orange: Colour a water source orange if there are moderate environmental problems at the water source. Student teachers should draw the causes of these problems onto the map.
 - Red: If the water source is highly polluted, it should be coloured red. The causes of the problems should be drawn onto the map.

5.4.8 Lesson 8 Reporting on water sources survey

Activity 1: Feedback and presentation on survey (30 minutes)

- Ask student teachers the following questions:
 1. What were your experiences during the survey: was it easy to observe?
 2. Did you have easy access to the water source for observation?
 3. Was it easy to interview the users of the water source?
 4. How were the interviews?
 5. ...?
- Ask each group of student teachers to present their map and the colours they assigned to the water sources: each group explains why they decided to colour the water source green, yellow or red (i.e. present the problems or positive things they found out during the survey).
- The teacher trainer lists down the problems of the water sources on the blackboard (activities that are polluting, location of the water source is polluting,...)
- Group discussion (compile new groups, not the same groups as the survey groups): The teacher trainer assigns one or more problems to each group (a different problem to each group). Each group discusses possible solution(s) for their problem.
 - E.g.: *the water source is surrounded by garbage, garbage flows into the water source. Solution: provide garbage bins close to the water source, try to convince the villagers to use them and make them aware of the importance of the water source.*
- Different problems and solutions are presented; other students can add more ideas as solutions.
- Draw the conclusion: "Many problems can only be solved by awareness raising and behaviour change among the villagers": Awareness campaigns are necessary.

Activity 2 Video clip "Water Consumption" (10 minutes)

- ☐ Play the video clip "Water Consumption" on DVD 2 clip 5.4.8 (8 min)
- Ask questions after watching the video clip:
 - 1) What are the main problems related to the use of water sources?
 - 2) Are they similar /different to the problems identified in your survey?
 - 3) Are the different solutions you proposed in the previous lessons also applicable for the problems in the video clip?
 - 4) Are other solutions for the problems necessary?
- The teacher trainer summarises the main points.

5.4.9 Lesson 9 Water cycle and environment

Activity 1 Demonstration of “How much water for us”⁸ (15 minutes)

- Brainstorming questions:
 1. Where can water be found on earth? (brainstorm): (*oceans, seas, rivers, underground, ponds, atmosphere, ice-caps, lakes*)
 2. What percentage of the earth is covered with water? (*75 % or $\frac{3}{4}$ of the earth is covered with water*)
 3. How many per cent of all water is usable for human consumption? Let students guess, but don't give an answer just yet. Continue with the demonstration activity below which might help them re-evaluate their assessment.
- Ask the student teachers to measure 2200 ml (2,2 litre) of water and pour this into a bucket. If a measuring cup is not available use a small plastic water bottle 250 ml may be used.
- Tell the student teachers to assume that this amount of water (the 2,2 litre) is all the available water on the earth (oceans, icecaps & glaciers, rivers, lakes, ground water, water in the atmosphere, inland seas and salt lakes, ponds).
- Ask a student teacher to measure out 12 spoons of water into a small transparent container. Tell the class that this is the total amount of fresh water on earth.
- Ask the student teachers where fresh water can be found (*Lakes, rivers, ice caps and glaciers, water in the atmosphere and ground water*).
- Ask the student teachers if all fresh water can be used for human consumption? (*water in ice caps and glaciers can't be used, not available*).
- Ask a student teacher to remove 2 spoons of water and put it in another glass. This water represents the ground water. Of course not all the ground water can come at the surface for use.
- Ask another student teacher to remove half a spoon of water and put that in another glass. This water represents all the fresh water lakes on the earth (including Tonle Sap).
- From the remaining water in the small container (which has now about 9 $\frac{1}{2}$ spoons of water, let 1 student teacher remove 3 drops of water using a ink-dripper or pipette. Tell them that this represents all the water that is in the atmosphere (before it falls down as rain or snow).
- Let another student teacher remove 1 drop of water and explain that that one drop represents all the water that can be found in rivers (including the Mekong River of course).
- The small container will now have a little over nine spoons of water left in it. Tell the student teachers that this represents the amount of water stored in ice-caps. This is fresh water that is unusable for human consumption.
- Let student teachers make conclusions: how much water of the total of 2,2 litres is usable as fresh water? (2 spoons of ground water, half a spoon of fresh water lakes, 1 drop of rivers)
- Tell them that actually less than 1 per cent of the total amount of water on earth is available fresh water (*the other 2 per cent of fresh water is caught in icecaps and glaciers and 97% of the remaining water is salt water in oceans and seas*), and even not all water of this 1 per cent can be used. Why not? (*Not all the ground water can be pumped to the surface, lots of ground water is confined under a layer of rocks in the earth and can't be pumped, some surface water (rivers, lakes) is polluted and therefore not useable,...*)
- If you use this activity to introduce the water cycle: ask the student teachers why the total amount of water on the earth is always the same? (*because of the cycle of water: water circulates on earth in different forms and on different places*).

☐ DVD 7 clip 5.4.9 Teaching activity: How much water for us (14 min)

⁸ From *Environmental Education Handbook, Teachers' Resource (Standard VI to VIII)*; Centre for Environment Education, 2005

Activity 2: PowerPoint presentation of different steps of water cycle (10 minutes)

Content book 5.2 “C”

- 🕒 Show the PowerPoint on the Water Cycle on Disc 3 folder 5.4.9.
- Each slide of the PowerPoint shows one step in the process of the water cycle.
- Ask 1 student teacher (a different student teacher for each slide) to come to the laptop and click on the right spot of the cycle. If the student teacher clicks on the wrong spot, ask them to watch the animation of the water cycle, which helps them to find the right place: there is a link to the animation when the slide shows that the answer is wrong.
- Another student teacher can come to try again.
- If the student teacher is correct, discuss the stage of the water cycle in more detail (to make sure that all student teachers understand that step in the water cycle)
- Another student teacher comes to the laptop to find the right place for the next step, etc.
- When the PowerPoint is finished, the student teachers are familiar with all the steps that take place in the water cycle.

Activity 3: Experiment: Water cycle simulation (15 minutes)

- Start the experiment with some questions:
 1. Can rain water taste salty? (e.g. when it is evaporated from the sea?)
 2. What do clouds need to let the raindrops fall down?
 3. What is the influence of water pollution on the water cycle?
- Basic instructions for the experiment:



Picture 16 Water cycle experiment



Picture 17 Water cycle experiment

Step 1

1. Ask student teachers to boil water on a cooking set (If this is not possible: bring boiling water to the classroom and ask them to pour it in a large bowl).
2. Ask the student teachers to cover the cooking pot with plastic transparent foil.
3. Wait until the water is condensed and sticks against the plastic foil.

Step 2

1. Add salt to the boiling water.
 2. Use drinking water mixed with soil as boiling water (brown water).
 3. Add different kinds of pollutants to the boiling water (chemical food colour, oil, perfume, detergent, ink,...): use gloves to add the pollutants
 4. To complete the experiment you need to put ice on top of the plastic foil: in order to cool down the condensed water for making rain.
- Ask the students to compare what is happening in the experiment with the stages water cycle:
 1. *Water evaporates when it is hot (evaporation in the water cycle takes place by sunlight, in the experiment that is simulated by boiling water).*

2. *The evaporated water condenses onto the plastic foil (condensation is formation of clouds).*
 3. *Ice makes the condensed drops become heavy and fall down as rain (cool air in the atmosphere causes rain).*
- Ask students to compare the variables: salt, pollution, ground,... with the real situation of water sources (*salt = sea, ground = river/lake, detergent, food colour, perfume,... = (chemical) water pollution*)
 - Ask the student teachers to compare all the rain water in the glass or in the bowl: students who caught the water with salt can taste it to test if it tastes salty or not. The other water (from the ground mix and the chemical pollution mix) should only be observed and smelled.
 - Ask the student teachers to make conclusions:
 1. What happened with the salt water after water cycle? (*not salty anymore*)
 2. What happened with brown water (mixed with ground) after the water cycle? (*looks clear*)
 3. What happened with the chemical polluted water? (*looks clear: no colour, no odor*)

Conclusion? (*Water cycle purifies water: only water particles evaporate and come into the atmosphere. Rain in the atmosphere is clean.*)

 4. Is all the rainwater purified drinking water? Let the student teachers think about what happens with rain water before we can use it. (*It falls down through the atmosphere which can contain pollution, especially in the cities, and the rain can absorb pollution, the rain also falls on dirty roofs, and/or is being caught in containers that might not be clean.*)
 5. So, what should we do with rain water before we use it as drinking water? (*We should boil it. Rain water in cities is less safe to drink as it can contain acids from air pollution (industries, transportation,...)*)
 - The poster "Water cycle" can be put up to help in compiling the conclusions.

DVD 7 clip 5.4.9 Teaching activity: Water Cycle Experiment (7 min)

5.4.10 Lesson 10 Safe Water Consumption

Activity 1: Introduction to Lesson: A Song called "water source" (10 minutes)

- Guide student teachers to sing a song called "Water Source". (Song printed in the Khmer manual only.)
- The following is the content of song:
 1. If we dive into a pond and we will catch three fish. The first two we make into fish paste and the third into Prahok.
 2. If we drink pond water we may get diarrhea because of pollution in the water and we are likely to get other diseases from drinking non-boiled water.
 3. If we drink boiled water or filtered water we will remove the risk of getting diseases and our health stays good.

Activity 2: Game: Finding Water Sources (15 minutes)

Content book 5.2 "D"

- Divide student teachers into 2 groups: Group 1 "water sources" and Group 2 "water use".
- Group 1 holds up and shows cards containing clean and polluted water sources: unfiltered/unboiled well water, pure drinking water, water from a filter, water at the pond, water at the lake, water at the river, lake water brought to a place away from lake/river, etc. (see Annex 5.4.10)
- The teacher trainer divides group 2 into 2 small groups: group 2a "clean water use" and group 2b "polluted water use".
Group 2a and 2b receive cards containing activities which require water for practical use (drinking water, showering, cleaning clothes, cooking rice, cooking meals, cleaning plates, brushing teeth, etc.) (see Annex 5.4.10)

The teacher trainer asks these 2 small groups to find the water source that is related to the activity on their card. The “clean water use” group shows good behaviour, the “polluted water use” group shows bad behaviour.

- The teacher trainer asks student teachers the question: which activity of water source use pollutes and which one does not pollute the water source?
The teacher trainer makes students aware that some students have the same activity on their card but they can go to different water sources: for example 1 student cleans the animal in the lake, and another one brings some water to clean the animal far away from the lake which causes less pollution for the lake.
- Each group has to clarify solutions for these activities. The teacher trainer can use the following questions:
 1. How does the construction of restaurants along rivers contribute to water pollution? What happens? Where did you see it?
 2. How does water which flows from a vehicle cleaning garage pollute the water? Please describe instances of this type of pollution that you have seen.
 3. Are you sure that pure drinking water made in local companies is of good quality? How can you determine its quality?
 4. What are the effects of growing crops near water sources? What are solutions for the problems caused?
 5. What do housewives have to do to get clean water for cooking and general use?
 6. Why haven't villagers changed their negative attitudes and behaviour? How will you educate them when you become a teacher?
 7. People who live on the Tonle Sap Lake always use water from Tonle Sap Lake itself for drinking and cooking. But on Tonle Sap there are toilets over the water. What do you think about this problem and how will you solve it?

Activity 3: Play video clip and discussion (15 minutes)

Content 5.2 “E”

- ☐ Play the video clip “Arsenic water consumption” on DVD 2 clip 5.4.10 (9 min).
 - The teacher trainer uses questions that encourage finding more solutions after watching the video clip.
 - Ask student teachers following questions:
 - 1) What are the ideas of people in the video clip?
 - 2) What are the problems with these water sources?
 - 3) How can these problems be solved?
 - 4)?

5.4.11 Extra activity 1: Art work - Water Drawings

Activity 1 Brainstorm ideas on all things related to water (5 minutes)

- Write down the following categories for brainstorming on the blackboard:
 - water sources
 - living things that need water
 - activities with water / near to water sources
 - things that you can see IN water sources
- Ask the students to brainstorm about the things related to water according to the above categories. All these ideas are written down on the blackboard or flip chart in the right category. Brainstorm until you have one word for each student teacher.
- Assign one word to each student.

Activity 2: Drawing of all the words related to water (15 minutes)

- Each student makes a drawing of the word that was assigned to them.

Activity 3: Matching 3 or 4 drawings (20 minutes)

- When the drawings are finished the student teachers walk around the classroom.
- They observe each other's drawings and discuss the content and try to form groups of 3 or 4 students, with drawings that are related to each other. For example, "river" (example of water source), "washing of clothes" (example of activity in a water source), "fish" (example of living thing dependent upon water), "soap" (example of something that can be seen IN the water).
- They find each other and they can make following connection between the drawings:
The river is full of fish, many people are washing their clothes in the river, river is polluted by soap and the fish can die.
- After all student teachers have formed groups of 3 or 4 students, ask them to present their connection and their environmental conclusion. Of course you can discuss with the whole class if the connections and the conclusions are correct.

☐ DVD 7 clip 5.4.11 Teaching activity: Parts of the lesson Water drawings (9min)

5.4.12 Extra activity 2: Erosion and water pollution

This lesson can be used in a lesson on forestry too.

Activity 1 Draw the water cycle (10 min)

- Lead student teachers to draw the water cycle and use arrows to show the movements of the water cycle. Water cycle pictures should include: sea, sun, clouds, rain, mountains, forest, river and use red arrows to show the evaporation movement and condensation of clouds. Use blue arrows to show where the water runs off the surface.

Activity 2: Experiment on relationship between forest, erosion and pollution (30 min)

Materials for the experiment:

- 2 big bowls (at least 50 cm diameter), 2 pie plates (smaller than the bowl): should be at least 3 cm deep, a watering can (to simulate rain), glasses or plastic cups (half plastic water bottle), rubber gloves

Materials to make islands:

- Clay soil and soil with grass.

Pollution and trash:

- Vegetable oil, food colouring (powder in very bright colour), perfume, rice (raw), small pieces of a plastic bag, paper.

The experiment:

- Ask student teachers to build 2 experiment sets according to the instructions (ask different student teachers to carry out each step):

1. Take pie plates to make the islands:
On 1 pie plate you make a mountain with clay soil.
On 1 pie plate you make a mountain with soil and grass (you can make a layer of clay soil covered with a layer of soil with grass.
Make sure that the mountains are solid.
2. Put the islands in the sea: put each in one of the 2 bigger bowls.
3. Ask student teachers to wear the gloves. Then put perfume and food colouring, vegetable oil, small pieces of plastic bags, paper etc. on the islands (don't let polluted substances flow into the sea).
4. Ask a student teacher to fill the watering can with clean water and select a student teacher to pour the water carefully over the islands to simulate rain.
5. Ask the student teachers to observe carefully how the rain washes dirt and pollution off the island into the sea.
6. Ask the students to answer the following questions:
 1. What happened when water was poured on the islands?
 2. Was there a difference between the 2 islands? If yes, what was the difference?
 3. How can you explain the difference?
 4. List 2 conclusions, or things that you have learnt from this experiment and relate them to the real world.

Suggested answers for the questions are:

 - a. *Pollution runs off into the ocean.*
 - b. *Less pollution runs off on the island with grass.*
 - c. *The grass prevents erosion and prevents pollution and waste to flow into the sea after rain.*
 - d. *Conclusion 1: Run off of water (as part of the water cycle) can cause water pollution. Conclusion 2: Land without vegetation or forests, is more vulnerable to erosion and erosion takes also land pollution into the water (lakes, rivers, sea, ocean,...)*



Picture 18 Experiment on erosion

Chapter 6 Environment of River

6.1 Background

The Mekong River and Tonle Sap Lake system dominate the water cycle of Cambodia. The Mekong River begins in the Tangha Shan Mountains in the Tibetan Plateau and flows through Burma, Laos, Thailand, Cambodia and Vietnam. The Mekong River is reported to be between 4200 kilometres and 4900 kilometres long and is the twelfth longest river in the world. 500 billion m³ of water flows down the Mekong River each year making it the third largest river in the world. Eighty-six per cent of the land of Cambodia lies within the catchment of the Mekong River.

The Tonle Sap Lake, also known as the Great Lake, lies in the centre of Cambodia and is connected to the Mekong River at Chaktomuk by the Tonle Sap River. The Great Lake is the largest permanent freshwater lake in Southeast Asia. The Tonle Sap – Mekong River system has a unique feature. Each year during the wet season the Tonle Sap River reverses its direction allowing the floodwaters of the Mekong to flow into the Great Lake.



Picture 19 Flooded forest in Tonle Sap Lake

6.2 Objectives

At the end of this chapter student teachers

Knowledge

- can explain the importance of the Mekong River for Cambodia and its neighbouring countries as they have learned through strategic questions, watching the video clip and consideration of the fiction and non-fiction texts.
- can explain the negative effects of building a hydro dam in the Mekong River on the environment and society which they have learned through the educational game, strategic questions and class discussion.
- can list human activities that decrease fishery resources, decrease economic development and increase the sustainability of the environment as they have learned in the educational game, through strategic questions, watching video clips and discussion.
- can name measures that can protect and conserve the ecology system and biodiversity in Tonle Sap Lake as they have learned through strategic questions, watching video clips and discussion.

Skills

- have improved analytical skills regarding environmental issues that arise in Cambodian society through consideration of the fictional and non-fictional texts.
- have improved critical thinking skills for evaluating the trade-off between economic profit and the negative impact upon society and the environment by evaluating the negative consequences of hydropower dams.
- can find and analyse causes the decline of fishery resources in Tonle Sap Lake by reflecting upon questions of teacher trainer.

Attitude

- are motivated to advocate the preservation of the Mekong River and Tonle Sap Lake.

6.3 Teaching aids

Lesson 1 Video clip of “Forecast Mekong” DVD 2 clip 6.4.1, video clip “Save the Irrawaddy Dolphin” DVD 2 clip 6.4.1, DVD player/laptop or TV/projector, true or false statements (see Annex 6.4.1)

Lesson 2 Chalk or sticks to mark the field

Lesson 3 Video clip “Lack of Fish in Tonle Sap Lake” DVD 2 clip 6.4.3, DVD player/laptop or TV/projector, ball

Lesson 4 Video clip “Save Our Great Lake” DVD 2 clip 6.4.4, DVD player/laptop or TV/projector, Role play card on community fishery (1 set = 11 cards). (see Annex 6.4.4), Number of sets of role play cards depends on the number of student teachers. (If you have 30 student teachers you need 3 sets.), poster “Use of flooded forest” and poster “Tonle Sap Lake Ecosystem”

6.4 Teaching procedure

6.4.1 Lesson 1 The importance of the Mekong River

Activity 1: Watch video clip “Forecast Mekong” (15 minutes)

Content 6.1

- ☐ Show the video clip “Forecast Mekong” on DVD 2 clip 6.4.1. (14 min)
 - Ask questions like: How many Cambodian provinces does the Mekong run through? What resources does the Mekong River provide to Cambodia? Etc.....?

Activity 2: Discussion on content of DVD – using the True or False statement quiz (25 minutes)

- Give student teachers the true and false statements (see Annex 6.4.1).
- The student teachers read and decide if they think the statement is true or false and why.
- Ask another student teacher who holds the card with right answer to explain if it is true or false.
- The teacher trainer summarises the main points.

Extra activity: Video clip Save the Irrawaddy Dolphin and discussion

- ☐ Play the video clip “Save the Irrawaddy Dolphin” (DVD 2 clip 6.4.1) (8 min)
 - Ask questions like:
 - 1) Where in Cambodia does this dolphin live?
 - 2) Based on estimations how many dolphins are there nowadays?
 - 3) What is the main cause of death of the dolphin?
 - 4) What are the advantages of dolphin conservation for Cambodia?
 - 5) How can we promote awareness and encourage people to get involved in sustainable dolphin conservation?

6.4.2 Lesson 2 Consequences of hydro dams

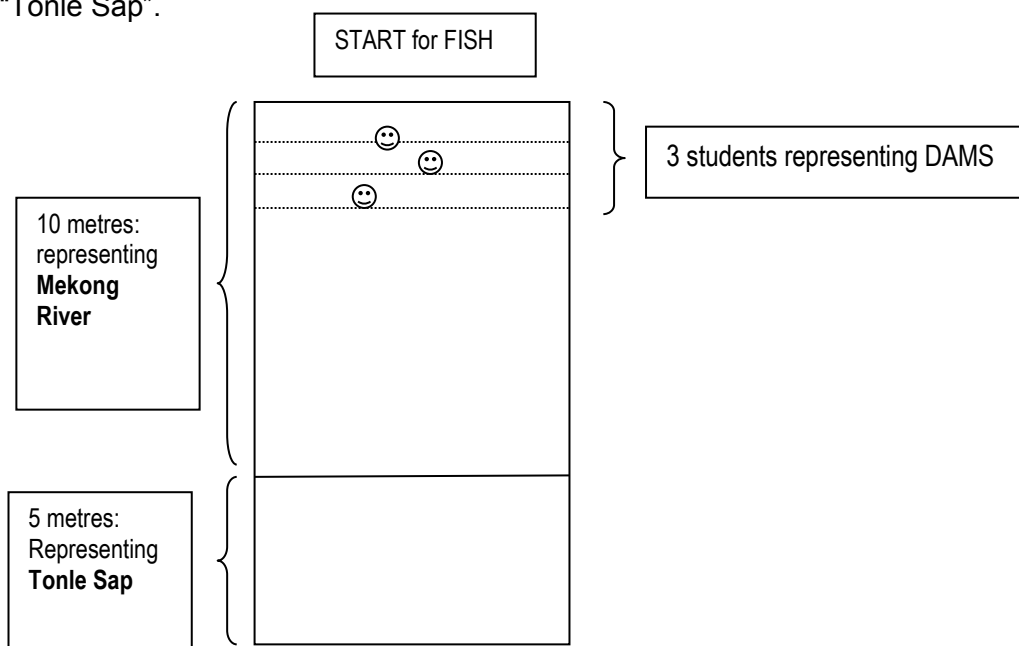
Activity 1: Educational game “Dams and fish” on consequences of dams (15 minutes) Content 6.1 “B”

Preparation of the game fields

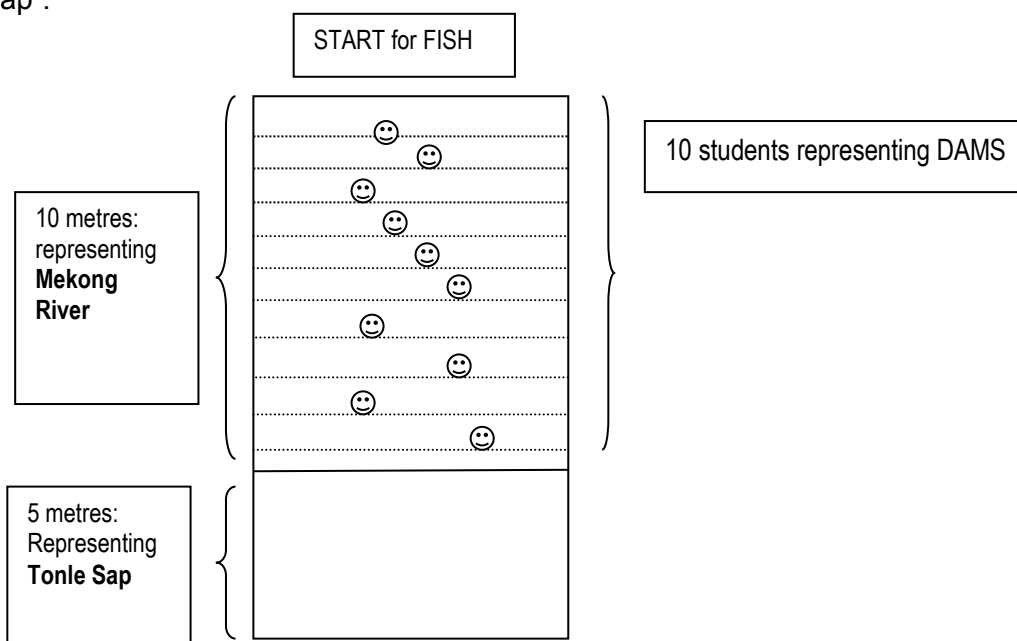
Prepare 2 game fields of at least 5 metres across and 15 metres long. The game should be played outside. Mark the game field as described and sketched below. If you have a concrete game field, you can use chalk to mark lines, if you have a grass field: use ropes

and/or stones to mark the different places in the field. If you have a sandy or soil field, you can draw lines using a stick.

Game field 1: mark the borders of the field, make 3 lines upon which the DAM students have to stand (they can move along the line to catch the “FISH”), and make one line to mark the field of the “Tonle Sap”.



Game field 2: make the borders of the field, make 10 lines on which the DAM students have to stand (they can move along the line to catch the “fish”), make one line to mark the field of the “Tonle Sap”.



1) How to divide the student teachers into 2 groups.

- Group 1: you need 3 student teachers who are representing DAMS (game field 1)
- Group 2: you need 10 student teachers who are representing DAMS (game field 2)
- All the other student teachers represent FISH: divide the remaining students over the 2 groups, so that you have the same amount of fish in each group. E.g. if you have 40 student teachers: 13 of them are DAMS (3 in group 1 and 10 in group 2), 27 student teachers are left: put 13 student teachers as FISH in group 1 and 13 student teachers as fish in group 2. Appoint 1 student teacher as observer and reporter.

2) How to play the game.

- Play the game at 2 fields at the same time.
- Tell all the students who will represent dams to take position on the damming lines, so 3 students go to field 1, 10 students go to field 2.
Explain that the “dam student teachers” of both groups are dams in the upper Mekong region.
- Tell the DAM students that they can move along the line to try to catch the fish, but they are not allowed to leave the line (so they can only move to the right or to the left, not forward or backward).
- FISH take their position at the beginning of the game field (start field).
- On a clap or a whistle the fish start swimming (running) through the Mekong and try to reach Tonle Sap. Dam students have to catch the fish by touching them. If 1 fish has been touched by a dam he is caught and goes outside the play field. These fish students were not able to reach the Tonle Sap.
- Ask the observer and reporter to take note how many fish reached the Tonle Sap in group 1 and how many in group 2. The observer reports to the class.
- You can continue the game for a few more rounds, but change the roles (dams become fish, fish become dams. The observer takes notes of the fish that arrived into Tonle Sap in each round.

☐ **DVD 7 clip 6.4.2 Teaching activity: Educational game Dams and Fish (9 min)**

Activity 2: Discussion on the consequences of building dams (20 minutes)

Content book 6.1.B

Discussion questions can be:

1. What was the difference between both game fields? Where were the dams located in the first field? *(Field 1 had only 3 dams, field 2 had 10 dams). Explain that field 1 can be compared with the reality at the moment: there are 3 dams operation in upper Mekong Region (China) at this moment. And that there are many more (around 16) dams are under construction or being planned to be built, as simulated in the second field.*
2. Why are dams being built? Who are the beneficiaries of dams? *(Hydropower, providing electricity)*
3. Evaluation of the game: what was the difference between field 1 and 2? What was the reason? *(Much fewer fish reached Tonle Sap in game field 2 because there were many more dams to catch the fish).*
4. How can the game be compared with the reality? What do you think is the influence of dams on fish population in the Tonle Sap (and lower Mekong Region)? *(Dams block water supply and migrating fish, which is necessary for the natural ecosystem in Tonle Sap which is fed by the Mekong. At this moment only little influence of dams can be seen on fish population in the Tonle Sap, but the future forecasts a different scenario, as much more dams are under construction or planned to be built. Specialists are very pessimistic about the fish population in Tonle Sap when all the planned dams are completed).*
5. What are the consequences of a smaller fish population in the Tonle Sap? *(Problems of livelihood of fishermen, lack of fish to supply Cambodian population, 2 million Cambodians are dependent upon Tonle Sap for their livelihood,...)*
6. The fish population in the Tonle Sap is already decreasing: even though not many dams have influence yet. What is the reason? *(Overfishing, use of illegal and industrial fishing equipment,...)*
7. What are other threats for the Tonle Sap Lake (discuss briefly the problem of water pollution in Tonle Sap, both by domestic pollution and industrial pollution)?

6.4.3 Lesson 3 Illegal fishing

Activity 1 Educational game on lack of fish in Tonle Sap Lake (15 minutes)

Content book 6.2

5. Ask student teachers to stand in a circle and pass the ball from one person to another. They have 5 seconds to say one name of a fish without repeating a previous one. The first student teacher who cannot find think of a new fish is out. Carry on the game until more students are out.
6. The teacher trainer records the names of fish which are named by student teachers on the blackboard.
7. Brainstorming questions:
 1. Which breed of fish is most common?
 2. Which fish breeds were common for your parents' era but are no longer common?
 3. Do know you why these fish are not as common as they once were?

Activity 2: Watching video clip Lack of Fish in Tonle Sap (25 minutes)

8. Brainstorming question:
 1. What kinds of fishing can be found in Cambodia?
Expected answer: family fishing, private company fishing, fishing for fun,...
 2. Which fishing technique affects fishery resources?
Expected answer: use of illegal fishing equipment and fishing during the prohibited season.
- ☐ Watch "Lack of fish in the Tonle Sap" on DVD 2 clip 6.4.3 (6 min)
9. Discuss the following questions with the student teachers after watching the video clip.
 - 1) What are the benefits of fish for Cambodian people?
(Most Cambodians like to eat fish because it is high in protein and low in cholesterol, it helps to stimulate the growth in children. Furthermore, a nutritious food that is readily available for people in living in rural areas).
 - 2) What are the threats to fish species in the Tonle Sap Lake?
(Electric shock and removal of juvenile fish stock, fishing in the reproductive season, destruction of the flooded forest, poor management especially in the implementation of fishing regulation).



Copyright © Osmose

Picture 20 Fishing at the Tonle Sap Lake

- 3) What should we do to increase fish stocks?
(Encourage fish farming, including community fish farming where ponds or lakes are available. Develop fish reproductive stations all over the country, develop fishing communities to conserve and police illegal fishing in Tonle Sap Lake.
- 4) What do you know about development of Community Fishery?
(Community is very important because it strongly supports civil society and encourages villagers to participate in conserving fish stocks in a sustainable manner. Currently Community Fishery is becoming more common day by day because communities understand benefits they will get. Community Fishery independently prevents and cracks down illegal fishing in many cases).

6.4.4 Lesson 4 Tonle Sap Lake conservation

Activity 1 Video clip “Save our Great Lake” (20 minutes)

Content book 6.2

10. Hang up poster “Tonle Sap Ecosystem”. The teacher trainer explains aspects of Tonle Sap Lake using the poster.
 11. Ask student teachers to find answers to the following questions while watching the video clip:
 - What is this video clip about?
 - Why do these problems happen?
 - Why do fish stocks decrease?
 - What is the view of the fishermen?
 - What is Community Fishery? What benefits does it provide to a fishing community?
- ☐ Play the video clip “Save Our Great Lake” DVD 2 clip 6.4.4 (9 min).

Activity 2 Role Play on tasks of fishing communities (20 minutes)

12. Hang up poster “Use of flooded forest”. The teacher trainer explains aspects of the use of the flooded forest.
13. Then divide student teachers into groups with 11 (or more) student teachers. Each group receives one set of role play cards (see Annex 6.4.4). Each student needs one card with the description of their role.
14. Tell student teachers that they have to advocate for the position described on their cards. They all participate in the discussion and use arguments for the idea on their card.
15. The aim of this meeting is to find solutions for the problems described on the role play cards and allocate the tasks of fishing community.
16. If you have more than 11 people in one group some of the actors can be played by two people (for example have a few more fishermen).
17. Student teachers take a few minutes to prepare their role. They have to pretend that they are in the real situation.
18. Explain to the player that plays the commune chief that he/she will lead the discussion and decision making processes to find solutions for the problems. He/she has to make sure that all participants in the meeting have a chance to express their ideas and suggestions. At the end of the meeting, the discussion should result in a conclusion, and decisions for the future. The commune chief is responsible for this.
19. **Evaluation:**
 - The commune chief shows the solutions which have been selected. Student teachers write down the solutions on the blackboard.
 - Compare the solutions. Are they similar to each other? What are the differences? Which solutions are the best and can be implemented effectively?

Annex list

Lesson	Activity	Title	Page
1.4.2	Activity 2	4 case studies on “Education for Sustainable Development”	50
2.4.1	Activity 2	Picture cards for Game Web of Life	53
2.4.2	Activity 3	Wetland Map and Outline Map of Cambodia	56
3.4.1	Activity 3	Poem “Beauty of the forest”	58
3.4.3	Activity 1	Name Cards Endangered and abundant species	59
3.4.3	Activity 2	Story Text: The regrets of a hunter	60
3.4.4	Activity 2	3 Case studies on Mine resources	61
3.4.5	Activity 2	Newspaper articles on Climate Change	63
4.4.1	Activity 2	Survey sheets for Home and Community Survey	65
4.4.3	Activity 2	Monitoring chart for Life Time	67
4.4.4	Activity 3	Survey sheet for School Waste Audit	68
5.4.1	Activity 2	Word Cards for finding partner game	69
5.4.2	Activity 1	Situation cards	70
5.4.2	Activity 1	Solution cards	71
5.4.3	Activity 1	Picture Cards with different kinds of waste	72
5.4.3	Activity 1	9 places of common rubbish disposal	74
5.4.4	Activity 2	Role play cards on plastic problem in our village	75
5.4.7	Activity 2	Examples of observation chart and questionnaire	76
5.4.10	Activity 2	Water sources cards and Water use cards	77
6.4.1	Activity 2	True or False Statements	78
6.4.4	Activity 2	Role play cards on Community Fishery	79

1.4.2 Lesson 2 Education for sustainable development

Activity 2 Four case studies “Education for sustainable development”

Case study 1:

The Chambok Community Based Eco-Tourism (CBET) is conserved by people from the local community.

The Community Based Eco-Tourism site Chambok, which has a beautiful waterfall, was established in 2002. It is located along the road to the Kirirom resort. The main purposes of developing the Chambok CBET were to reforest and create tourism services for income generation. Traditionally, the Chambok people hunted, logged, and grew rice and other crops to support their daily life. As a result, most of the big trees were nearly cleared from the forest and wild animals like deer, rabbits, wild pigs, musk deer and pandas are seriously threatened. The profits obtained from exploiting the local environment largely went to foreign corporations who employed the locals.

As a result of the CBET project, people in the community worked closely together on reforestation, and creation of a tourism project. Since the conservation activity began, it seems that the number of trees is increasing.

Mr Touch Morn, CBET Chief, said “I do not have any modern technological tools to measure the number of trees, but the people can see it by their eyes”. He added that most Chambok people understand the advantages of natural resource conservation for tourism services. In fact, a man who used to cut down trees became a tour guide. A family that had run the charcoal business now sells gifts, food and provides homestays and cow cart rental services etc. He added also that before the CBET was established, local people never cared about the loss of natural resources.

Mr Thay Hong, 67 years old, a CBET member, said that illegal logging at this site was no longer happening. He also said that he, and other members of the community, are very happy with this job because they love the forest, even though they do not get any salary.

Case study 2:

Demands for development to reduce poverty

A new report from the WWF organization found that an accurate appraisal of number of catfish in the Mekong River shows that the catfish will become an endangered species if the development of a hydro dam in the Mekong River goes ahead. Big fish species like catfish and Kulriang fish are seriously threatened by the development of the hydro dam along the Mekong River, especially the hydro dam in Laos.

The catfish and Kulriang fish are symbols of Cambodia, and they are some of the biggest fish in the world. A big catfish or Kulriang is about 300 Kg, and it is classified as the fifth biggest fish among the top 10 fish in the world. Nowadays, both fish are endangered species.

Mr Roger Molot, a biologist of WWF Laos, stated that big fish such as the catfish cannot move across the hydro dam to the upper layer of Mekong River for reproduction. With this situation, the number of such important fish is going to decline.

The scientific data shows that the catfish moves from the Tonle Sap Lake to the North zone of the Mekong River near Thailand and Laos for reproduction. The hydro dams are built at the bottom layer of the Mekong River and will be an impassable barrier for those catfish. The declaration of the WWF organization also stated that the hydro dam development project in Sayapoly Province in the north zone of Laos is a threat to the catfish. The Sayapoly hydro dam is the first dam at the bottom layer of the Mekong River, and it is going to be evaluated before other Mekong River Committee Members consult on the construction.

The declaration also noticed that the hydro dam construction at the bottom layer does not affect only big fish, but it also affects the climate in the Mekong River system, which is a multi-fishery site and diverse agriculture site.

Case study 3: Economic Concession Land

Providing economic concession land in the Lang Forest (the evergreen forest) to private companies is profitable for the government, but it has a very negative impact on the local people because they have depended upon collecting timber and non-timber forest production for their livelihoods for many generations. The Lang Forest is vital for local culture, belief, and the survival of different ethnic groups, and it also is the habitat for many endangered species, namely the elephant, the wild cow, the tiger, and the Asian black panda.

Mr Choun Long, 24 years old, is a farmer at Tbong Toek Village, Sandan District, which is 60 km away from the town of Kampong Thom Province. He is a resin and wood oil collector. He said that the loss of the forest is the loss of his family income.

“Our society is losing the forest, and it will cause drought and affect the environment, especially the wood oil that we usually collect to support our family, it will be empty too.”

There are approximately 250,000 people living on 5,000 km² around the Lang Forest, which borders with 4 provinces, Preah Vihear, Kratie, Stung Treng and Kampong Thom. Those people depend upon the timber and non-timber forest production such as resin, wood oil, and rattan.

Mrs Bak Kimsokh, 57 years old, is a representative of a village in Sandan District. She has protested the cutting down of trees on this site, with the claim that the loss of the Lang Forest means the loss of the community. Currently, people are protesting for the government not to allow any company to clear the forest. How can we live if the forest is cleared?

At least 2 Vietnamese companies, PNT Co., Ltd and C.R.CK Rubber Development Co. Ltd, received economic concession land for rubber tree plantations from the royal government of Cambodia in May, 2010. According to the Ministry of Agriculture, Forestry and Fishery, the PNT Co., Ltd received 7900 hectares in Rovieng District, Preah Vihear Province, and the C.R.C.K received 6155 hectares in Sandan District, Kampong Thom Province.

Dep. Governor of Kampong Thom Province said that providing economic concession land to these companies creates job opportunities for the local people. “We want to transform the mind-set of local people from unsustainable non-timber forest production collectors to be workers for the rubber tree plantation. The first purpose is to ensure the sustainability of their work. Secondly, it is a good chance for them because they do not have to immigrate to work in Thailand.”

However, the local people said that they do not want to work for the company.

Mr Heng Hout, Chief of the Provincial Department of Environment in Kampong Thom, stated that trees in the Lang Forest are very old. They should be cut down according to the techniques, because it is just a change from the natural forest cover to be a rubber forest cover. The official permission of the royal government is to develop that area to still have a green forest cover. When the change of forest cover is an investment it provides lots of benefits to the country and those benefits will reach to the people who live in that area first. People will get benefits from the investing company.

Case study 4: Understanding of the environment

In Phnom Penh infrastructure development has been noticeable in recent years. Waste management is a major challenge for the capital. Many kinds of waste are not disposed of in bins, but instead disposed of at markets, hospitals, factories and boulevards around the capital.

People who live at the centre of the capital and at urban areas near to the waste piles frequently complain about the bad smell from the waste. Mrs Seang Seng, who lives in Dangkor District, Phnom Penh, said that “the waste pile is about 5 meters, and it attracts many flies, however, I tried my best to clean it. [SIC]”




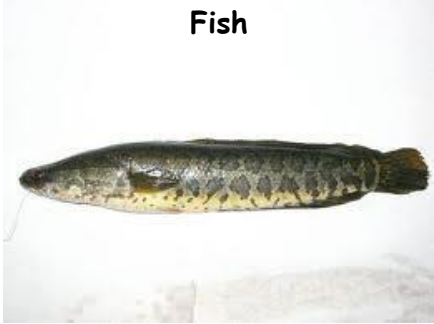




Mr Va Moeun, Director of Mlum Baitong Organization, which focuses on environmental education, found that the lack of waste bins and low understanding of the environment causes bad waste management in the capital. Waste management at home is acceptable as the Cintry Company collects household waste regularly. But different kinds of waste are disposed of in public locations. Some waste is put into bins, however, it is still not proper waste management. Most Cambodian people have a low understanding of the environment, especially waste management.

Mr Heng Yonkoura, Program Manager of Community Sanitation and Artificial Organization (CSARO), said that, although some people feel disgusted with the waste, some waste can be used to produce various kinds of equipment. "Personally, I accept that it is very difficult to ask people to segregate waste into recyclable and non-recyclable forms" he says. Therefore only relevant authorities can solve this problem by establishing Processing Centres at each waste disposal place.

In response to the above problem, Mr Marn Chhoeun, Dep. Municipal Governor, said that the Municipality plans to close the Stung Meanchey waste disposal and then open a new one, which follows the international standard, including a processing centre. It will not use the old system. With the new system, it is going to sort the different kinds of waste, for example, kitchen waste, dangerous waste, and waste which is harmful to people's health.

2.4.1 Lesson 1 Biodiversity

Activity 2 Biodiversity: Picture cards for the game Web of Life

<p>Sun</p> 	<p>Water</p> 
<p>Snake</p> 	<p>Fish</p> 
<p>Bird</p> 	<p>Bear</p> 
<p>Cow</p> 	<p>Chicken</p> 

Tree



Worm



Humans



Monkey



Pig



Soil



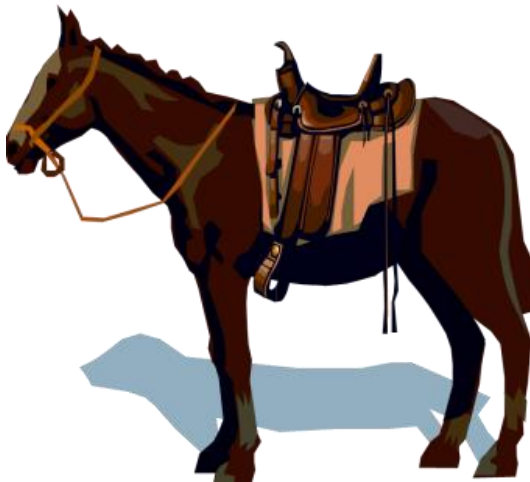
Eagle



Tigre



Horse



Turtle



Wind

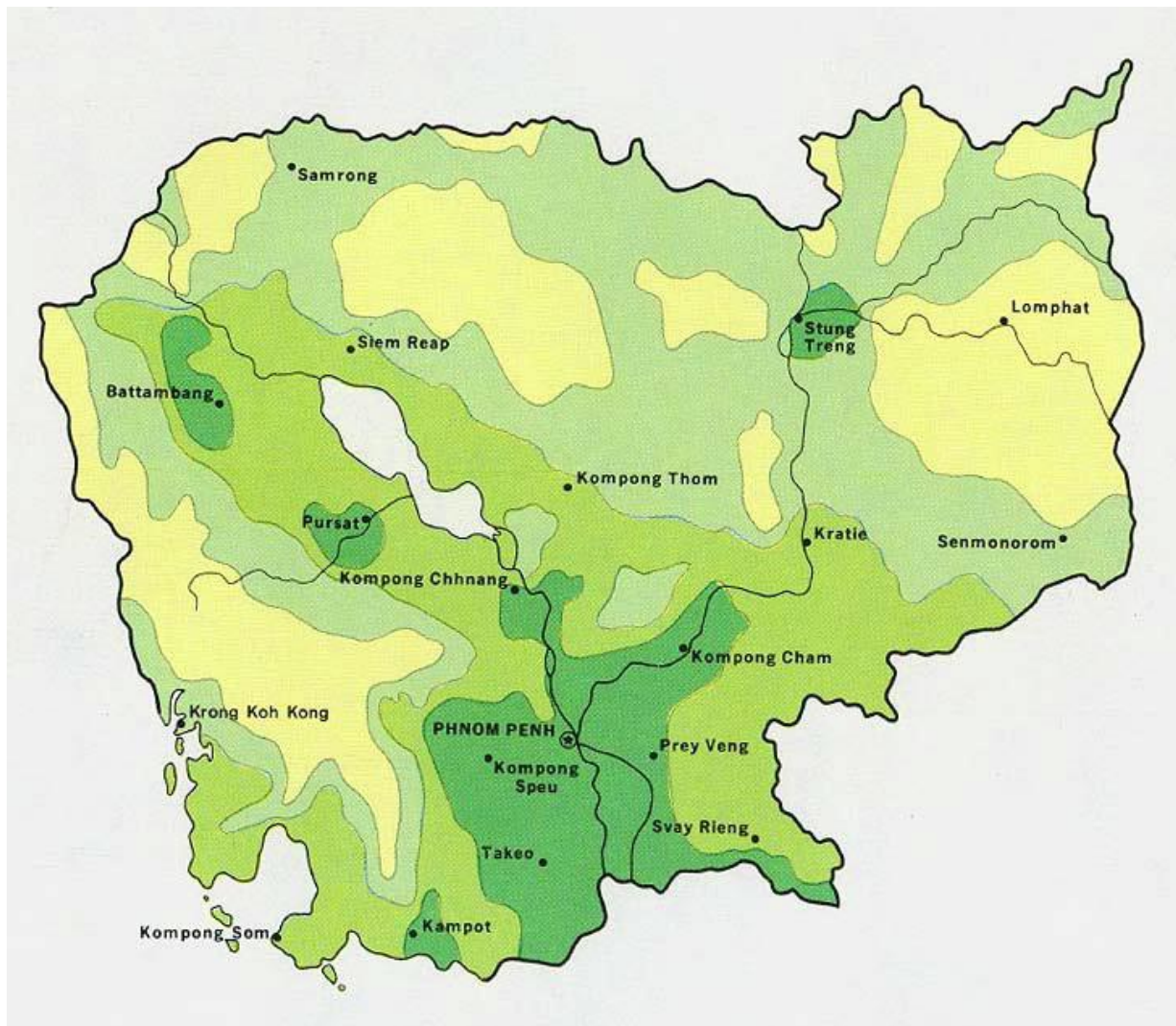


Ant



2.4.2 Lesson 2 The ecosystem and Wetlands

Activity 3 - Wetland map and Outline Map of Cambodia



Picture 21 Outline Map of Cambodia Copyright © SCW 2006

តំបន់ដីសើម និង ទីជម្រាល Wetlands and Catchment Areas



កំណត់ត្រា

ទន្លេមេគង្គ (ផ្ទៃរាបលិចទឹក ជាង ២០០០០០០ ហិកតា) និងតំបន់ដីសើមទន្លេសាប (ទឹកជំនន់សរុប ១៥០០០០០ ហិកតា)

តំបន់ការពារភ្នំសារ

ផ្ទៃទឹក

ទីជម្រាលទន្លេមេគង្គ

ទីជម្រាលផ្សេងទៀត

តំបន់ឆ្នេរ

ទន្លេស្ទឹង

ព្រំប្រទល់អន្តរជាតិ

Legend

Mekong (over 2,000,000 ha of floodplains) and Tonle Sap

Wetlands (total inundation 1,500,000 ha)

Ramsar

Water Body

Mekong Watershed

Other Watershed

Coastal Zone

River

International Boundary

Note:

Watershed created by GIS Method (Catchment Area) using contour lines from GIS dataset 2002.

កម្រងឯកសារសិក្សា វិទ្យាស្ថានសិក្សា The School Atlas of Cambodia

Picture 22 Wetland Map Copyright © SCW 2006

3.4.1 Lesson 1 Types of forest in Cambodia
Activity 3 Types of forest in Cambodia: Poem “The beauty of the forest”

សម្រស់ព្រៃព្រឹក្សា

(បទពាក្យ៧)

វស្សាក្លៀងធ្លាក់ត្រជាក់ដី
ដំណាំលូតលាស់វារបោះទង
ធម្មជាតិព្រៃភ្នំខៀវស្រងាត់
រុក្ខជាតិតូចធំចេញផ្លែផ្កា
គន្ធពិដោរក្រអូបអង្គ
វាយោធាតុយោលពីនិរតី
គុយ គុយនៅញ័រកា
ស្រឡៅស្រលូនកូនគគីរ
គ្រញូងនាងនួនពួនអួតកាយ
ផ្កាផ្កាត្រច្ចក្រង់លង់សម្រស់
ស្រូលស្រល់ខ្យល់បក់ទោទន់ទៅ
សម្រស់ឆើតឆាយក្រៃក្រាស់ពេក
ឈើទាលសុក្រំគុម្ព ក្រសាំង
ស្រគំស្រគាលព្រៀលល្អគន់
រុក្ខជាតិតូចធំភ្នំស្រុកខ្មែរ
ទឹកជ្រោះហូរខ្ពស់បោះថ្មដាវ
ទេសភាពល្អៗកម្រក
សរសើរស្ងប់ស្ងែងស្ងួតគូរតិត
ថវិកាហូរហៀរជាចំណូល
ដោះស្រាយបញ្ហាគ្រប់ប្រការ

រុក្ខជាតិខៀវខ្ចីស្រស់បំព្រង
បោះត្រួយរំលងចុងព្រឹក្សា។
បាត់បង់សូរ្យសែងព្រះសុរិយា
ក្លិនក្លែងផល្លផ្កាឈើព្រៃ។
ដណ្តប់លើភពផែនទីទៃ
ផាត់ដោយសុះសាយពេញធរណី។
ដង្កោ ក្រៀលស្វាផ្កាមួយពីរ
ផ្ទឹក រាំង សុក្រី មីដេរដាស។
បុស្សបេងក្រាស់ក្រាយស្នាយកកោះ
ព្រះញ្ជៅនៅរស់ឈ្មោះល្អឯក។
អរំនាំផ្លូវទៅស្ថានប្លែក
ឈរភ្លើងភ្លើងស្តេកគួរគយគន់។
ម៉ាក់ប្រេងម៉ាក់ប្រាំងច្រើនពេកពន់
ក្លោមមាត់ បុន ថ្ងាន់ច័ន្ទចាកចារ។
ស្រស់ល្អប្លែកគេលើលោកា
មច្ឆាហែបហែលច្រើនពន្លឺក។
ទេសចរចូលមកច្រើនគគ្រឹក
ចង់តែនៃបនិក្សឥតសង្គា។
យើងបានប្រមូលជូនខេមរា
រាស្ត្រខ្មែរឃ្លាតចាកភាពក្រីក្រ។

3.4.3 Lesson 3 Wildlife

Activity 1 Wildlife - Endangered and abundant species name cards



Big tiger	Asia Elephant	Gibbon
Crocodile-fish	The Pdoa Turtle	Toad
Small green tree frog	Catfish	Kulriang fish
Gray Crane	Green peacock	Grey Pelican
Musk deer	Wild pig	Bat
Geckos	The Pul Prolit (poisoned water lily)	The Ros fish
Proul fish	Egret	Pelican
Deer	Local bird	Turtle

3.4.3 Lesson 3 Wildlife

Activity 2: Story text - The regrets of a hunter

There is an evergreen forest. It has many small and big trees, which give fruit and also provide cool shadow and safe habitats for several kinds of wild animals. It is near to a mountain and a pond and surrounded by many big trees. One morning, a hunter, Sokh, is quietly walking with a hunting-tool on his shoulder to hunt animals for daily consumption. He keeps walking while his eyes look for animals carefully.



Suddenly, he finds a pair of gibbons joyfully playing on a Khlong tree, and they do not realise that they are in danger. The female gibbon is nursing her baby on a branch of the Khlong tree. Pou Sokh decides to hunt the female gibbon because he cannot see any other animals. Immediately she is shot in her chest by his gun, while the male gibbon hides inside the Khlong tree frightfully.

The female gibbon was crying loudly with pain in her heart. One arm is trying to hold on to the branch, while the other is hugging her baby as her body bleeds. She fell down nearby the tree.

Because of the pain, the male gibbon suddenly jumps from his hiding place to hug his wife. She dies shortly after handing the baby over to her husband.

After seeing the sorrow of the gibbons, Pou Sokh fell down with tears of regret. And he whispered to himself "I should not do the worst thing to them". If I were them, I will feel more hurtful than them. I am sorry! I am a murderer!

After he found his fault, he promised that he will stop hunting wild animals from now on and that he will do all he can to preserve the wild animals.

3.4.4 Lesson 4 Mine resources

Activity 2 – 3 Case studies

Case study 1: Report on impacts of gold mine investment

On July 02, 2011, the Ratanakiri authority officers appeal to the local officers at Phi Village, Se San Commune, Oyadav District, to quickly report upon the local health impacts of the Vietnam gold mine investment Company in the Se San river area near the border between Vietnam and Ratanakiri Province. This appeal occurred after provincial authority officers received a report stating that the number of heavy machines of the Vietnam Company have increased to 3 and that they are pumping soil from the bottom of Se San river at the border of Yalay Province, Vietnam, which is 300 meters away from Phi Village, and the original place of the Charay indigenous people.

Vietnam Company has installed 2 heavy machines in the middle of the river, which is on the border between both countries. Sometimes, the machines move across into Cambodian territory. Also, the river is polluted by oil, chemical substances and acid, and the local people get skin problems when they have a bath.

Mr Sev Doeun, Chief of Phi village, said on July 02, 2011 that more than 10 children get an itchy disease on their whole body, which is caused by the pollution in the river.

In the same report, Mrs Romas Voeurt, the first Deputy Chief of Se San Commune, also said that many children and some older people got diarrhea from drinking the river water. His family always drinks boiled drinking water, but his grandchildren often got ill regardless.

Case study 2: Cambodia cancelled the Titanium mine investment in Koh Kong Province

The environmentalists and villagers applaud the rare decision of Mr Hun Sen, the Prime Minister of Cambodia, of cancelling approval of the Titanium mine in Koh Kong Province, which is in the Corridors Protection Area. An environmentalist said that this decision is absolutely right based on critical thinking on proposed titanium mining. The decision puts pressure on this project. The project has negative impact on local people especially on the areas that catch rain water.

Mr Hun Sen decided not to allow the company to invest in the Titanium mine in Koh Kong province because of his concerns about the impacts upon the environment, biodiversity and livelihood of the local people. The Wildlife Alliance Officers and community people judge the decision as of “great value to the forest”.

Mr Phay Siphan, a General Secretary and spokesman of the Ministry of Cabinet, said that the decision of Mr Hun Sen contributes to Climate Change Protection, Natural Forest Protection, Biodiversity Conservation and is in the interests of the local people.

Mr John Maloy, a spokesman of the Wildlife Alliance Organization of Cambodia, said that he is very excited with the decision of Mr Hun Sen. It is important that the government takes time to consider the impacts of mineral investment, especially the impacts upon both the forest and the local people. The statement of the Wildlife Alliance Organization clarified that it is a great success for conservation efforts in the rainforest area, which is nearby the Asian Region.

Mr Nget Ngon, Chiphat Village Chief, said that some villagers, who would get some financial return from the mineral investment, advocate the investment, and others, who would not get any financial return, also support this investment because they expect that it would create jobs.

Ms Suwanna Gauntlett, CEO of the Wildlife Alliance Organization, said that “We acknowledge that development is a vital thing for Cambodia’s future, but development should be implemented whilst respecting to the environment. The decision of Mr Hun Sen has helped conserve the forest, and this is to the benefit of the entire planet.

Mr Hun Sen declared that 4400 hectares of mineral investment concession land which was offered to the United Khmer Group Company was invalid immediately. The company predicted that it could get 1300 million US dollars per year according to a statement. The United Khmer Group has shareholders from Cambodia, Singapore and China.

Case study 3: A gold mine causing damage in Kampong Thom Province

A small group of people discovered the gold mine at Kamnop Neang Pov area in Phnom Chy area, Sandan District, Kampong Thom Province. Kamnop Neang Pov, which is 10 to 15 km far away from the Phnom Chy area, was found to be the edge of the gold mine. It is the third place that is discovered around the Phnom Chy area. In the last 20 years, they discovered lots of gold mine at the Snorng Orn point. Later on they moved to the O Phdav area because the Snorng Orn area does not have gold mines anymore but at that time the way of collecting gold is traditional, by hand.

Nowadays, they are unable to mine by hand. In contrast, remove forests and use explosives to get to the gold. They use about 10 kinds of chemical substances to mix with the original mined material, which is then grinded by machine, to produce the gold. The chemical substances damage biodiversity and also harm the local people who depend upon the stream water.

A gold miner briefly described the current method of producing gold. At the beginning, the workers dig a hole until they reach to the gold layer. Then, they grind the collected stones and soil, before they mix it with lime and several kinds of the chemical substances such as Soda (white powder), Sodium Cyanide, Oxide, Na_2O_2 , and H_2N . And the amount of each ingredient should equal with 2 m^3 of soil. Next, they put all ingredients and 1 m^3 of water into a pool which its bottom has a pipe system to deliver the first water into another small pool. Later on, they water around the soil again and again. And then they put the metal sheet into a small pool, and the dust of gold, which looks like the mud, is absorbed by the metal sheet. After that, they soak the metal sheet in the black acid and then white acid. Finally, they burn the dust of gold so they can get the useable gold. The chemical substances above are not available in Kampong Thom market, except for the lime that they can buy at Phnom Penh or the Me Mut market, Kampong Cham.

The mining activity causes pollution of the water. The chemical substances flow into many places, especially the water sources. Sometimes cattle will immediately die from drinking polluted water, and mine developers often pay money back to the cattle owner. Moreover, the polluted water will kill the trees and other living things around it. The workers are soaked with poisoned water that has a dangerous smell for at least 20 to 30 days per operation.

A Chief of Kamnop Pov village said that there are about 100 holes and 800 workers from 600 families. He adds that, in the dry season, some families go to work at the gold mine, some are vendors and some cut trees, which are used in construction and as fire wood, or to sell to workers at the gold mine.

3.4.5 Lesson 5 Climate change

Activity 2 - Newspaper articles on Climate change

Topic 1: The impacts of the climate change on humans and the environment

Climate change is causing negative impacts on agriculture production, water sources, human health, forests and ecosystems. Floods, droughts, storms and natural disasters have occurred more frequently and with greater intensity. Climate change also causes current and future problems such as loss of soil quality, biodiversity, local reproductive crop seeds, and the forest degradation.

Cambodia is an agricultural country, and it is threatened by climate change. Cambodia has identified the agricultural sector as an important sector to improve and grow the economy. The agriculture sector is dependent upon rainwater and natural water flows such as the annual flood of the Mekong River and Tonle Sap Lake as well as the sea-level. Therefore, Cambodia's agriculture can easily be affected by climate change, for example, the change of Mosong wind.

According to the report of the World Food Program and FAO, about 75 million people are facing especially people who live in developing and poor countries. Problems such as lack of water, lack of free land for cultivation, flooding, and drought, are made worse by climate change.

The result of an evaluation of climate change by the Ministry of Environment shows that global warming will increase the annual rainwater level in Cambodia from 3 to 3.5 %. Low land area, which is agriculturally important, is some of the most vulnerable land. A report of World Weather Forecast Organization stated that big events related to climate change such as wind, cyclones, floods, droughts, and heat-waves contribute to 75 % of global disasters. All of these seriously affect the economy, and health people around the world. In 2011, World Health Day celebrated a ceremony of "Health and Climate Change". It is celebrated simultaneously with people all over the world raising concerns about the current status of the climate change, and its impact on the health issue. The World Health Organization stated that the developing countries are threatened by the spread of contagious diseases. The Ministry of Health, Cambodia, said that climate change contributed to the dengue fever outbreak in the last year.

Topic 2: Causes of climate change

As we know, the forest is a vital air purification agent for all of us. But in recent decades, the forest has been illegally logged, and some have been lost when economic concession land was allocated in order to develop the country. If the management policy for agriculture and forestry is poor, many problems will continue to happen. The agriculture sector also contributes to climate change through forest clearing activity, agricultural and chemical pesticide use, and water use. 85% of Cambodian people live in rural areas, and 80% are farmers who depend on natural resources for their livelihoods.

The United Nations has predicted that environmental pollution from burning the fossil petroleum will cause floods, droughts, cyclones and icebergs melting. The UN also warns that change cannot be prevented completely, and that the global temperature may increase by 4 C° in this century while the level of sea water will grow by more than half metre. The environmental issue is a major problem for humanity. By protecting the environment, Cambodia is reducing the negative contribution to climate change.

Topic 3: Reduction methodology

The royal government has showed a political willingness to address the climate change issue based on the principles of the UN convention on Climate Change. Although, there is an effort by the royal government of Cambodia and international partners, NGOs, IO and

others in the private sector, it is still important for NGOs to actively participate and for people to seek understanding and adapt to climate change.

Review the national policies such as national policy of forestry, effective restoration and conservation of natural resources, implement mechanisms of development that does not harm the environment and REDD (Reduce Emissions from Deforestation and Forest Degradation). Those policies are urgent methods to reduce climate change.

Growing a tree is a self-help activity. If you have a garden or grow some flowers on your porch, you will feel like you are living in the forest of Phnom Penh. Moreover, those trees can absorb the Carbon dioxide and return oxygen to the atmosphere in which helps reduce global warming. Growing trees does not cost too much money, but it will provide lots of advantages for the next generation.

Think about waste collection and recycling because it can save you lots of money and help the planet as well. Paper, plastic, cans and bottles, which people dispose of every day, can be recycled into shoes, hats, belts and other gifts. If you have good intentions and love the environment, please join with us to protect our beautiful world together.

Conserving electricity reduces the burning of petroleum for production of power. Be mindful of small habits such as recharging the mobile phone and turning off the T.V, CD player, and computer etc. because it can contribute in power and expenditure reduction... Use a bicycle or motorbike for traveling short distances, and get involved in environmental campaigns.

4.4.1 Lesson 1 Different kinds of waste and waste segregation

Activity 2 - Survey sheets for Home and Community Survey

Task: carry out the survey during 1 week. Observe the waste that is collected in your home. Note each kind of waste and for each day, record the following information:

- Amount (e.g. 2 glass bottles, 5 tin cans,...)
- Type (e.g. newspaper, plastic bag, empty bottle, beer cans, batteries,...)
- How was the waste disposed? (Thrown under the house, thrown next to the street, collected by junk collectors, disposed in the garbage bin, thrown into the river,...)

Waste Detectives: home survey

Day	Type of garbage							Estimate the total weight of waste per day
	Paper	Plastic	Glass	Aluminium/tin/foil	Kitchen waste	Chemical waste	Other?	
Monday								
Tuesday								
Wednesday								
Thursday								
Friday								
Saturday								
Sunday								
Total kilo of waste in 1 week=								

Survey questions and sheet for Community Survey

1. Describe the location:
2. For each item of waste that you see, categorise it into one of the rows below:

Paper	
Plastic	
Glass	
Aluminium/tin/foil	
Kitchen and garden waste	
Chemical waste	
Other	

3. Describe the smell at the site:
4. What is the main cause of the smell? Which kind of waste causes the smell?
5. Is some rubbish burnt at the site? What are the consequences?
6. How can the waste on the site affect the environment?
7. What kind of problems can you identify at the site? What kind of problems could be caused by the waste?
8. If you are visiting a dump site: is this a legal dump site?
 - Did local authorities give the permission to use this place a dump site?
 - Is it a permanent or a temporary dump site?
 - Is it an open dump or land fill?
9. If you are visiting a dump site and you meet some rag pickers (junk collectors), try to interview 1 or more with following questions:
 - *What kind of waste they are collecting?*
 - *Do they know what's happening with the waste?*
 - *What do they earn collecting waste?*
 - *Are they collecting waste in a safe way?*
 - *How can people in the community help them in their work?*

4.4.3 Lesson 3 Bio-degradable and non-biodegradable waste

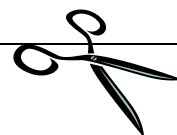
Activity 2 Monitoring Chart for Life Time activity

Name and description of the item:					
	Date	Colour (changed?)	Smell (changed?)	Other changes?	Conclusion
Before burying					
Monitoring 1					
Monitoring 2					
Monitoring 3					
Monitoring 4					
Monitoring 5					
Monitoring 6					
General evaluation after experiment:					

4.4.4 Lesson 4 The 3R's: Re-ducing, Re-using, Re-cycling
Activity 3 - Survey sheet for individual plastic bag use

Name of student teacher:	Class:
1. Do you bring plastic bags to school? List down the things which you bring to school in plastic bags.	
2. Why do you use plastic bags?	
3. Approximately how many plastic bags do you throw away in a day? And why?	
4. If you go shopping, do you bring your own shopping bag or do you bring a used plastic bag? And why?	
5. Can you reduce the usage of plastic bags? How? Give examples.	

5.4.1 Lesson 1 Air pollution
Activity 2 Word Cards for Finding partner game



Cause	Effect
City or town	High concentration of traffic and factories
Decrease air pollution	Better health
Research	New sources for clean energy
Natural forest	Helps to reduce CO ₂
Lots of vehicles	Smog
Public transportation	Helps decrease air pollution
Volcano	Primary pollutants in the air
Greenhouse gas	Global warming
Air pollution	Lung problems like asthma, bronchitis, lung cancer
Hole in the Ozone layer	Higher concentration of ultra violet light on earth

5.4.2 Lesson 2 Waste disposal in Cambodia

Activity 1 - Situation cards

You are shopping at the market. You bought some bananas and they put it in a bag. Now you are buying a papaya. What do you choose: you accept the extra plastic bag or you put the papaya in the same bag as the bananas, with the risk that the bananas will be squeezed by the extra weight of the papaya?

Your mother asks you to remove the garbage that's collected over weeks under the house. What do you do with it? There is a river just behind your compound and your neighbour just asked you to come over and play football with a few friends ...

Your mother has a small restaurant at home. Before and after school it is so busy that your mother asks you to help her clean up the mess under the tables (food leftovers, fish bones, tissues,...). As you are always hurried to be on time for school or to do your homework, you don't have much time. What do you do?

You are planning to go to the market. Your brother just told you that he learnt in school that plastic bags are a serious problem for the environment: there are too many plastic bags and they need almost 1 million years to decompose. But you can't find a good basket to carry all the fruits and vegetables you will buy at the market.

You are a member of the Green Club in your school. This means that you and your friends are responsible for proper waste management in the school. The system is working quite well: students are segregating waste. They put organic waste in the waste bin for making compost, and waste collectors come a few times a week to collect the recyclable waste from the recyclable waste bin. But the Green Club has to decide what to do with the non-recyclable waste, such as plastic bags and food packaging. What will you do with the non-recyclable waste of your school?



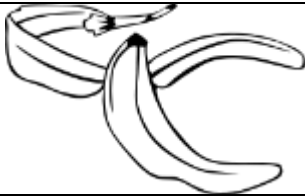



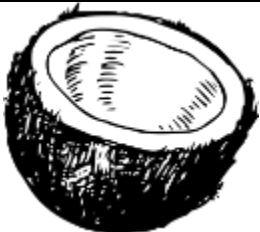

You are director of your primary school. During break, many sellers of sweets and cookies come to the school to sell these to the children. You allow them to do that, because they give you a percentage of the profit which you can use for maintenance of the school building. But the garbage that is left after each break (wraps of sweets) is plentiful. What do you do?




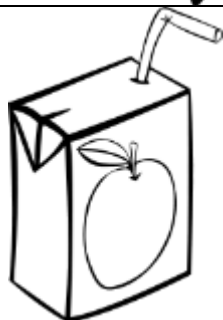



5.4.2 Lesson 2 Activity 1 – Solution cards

Throwing the waste into the river
Throwing the waste at the side of the street
Digging a pit to bury the waste
Burning the waste
Bring a shopping basket to the market for your groceries
Accepting plastic bags at the market
Reusing plastic bags that you find at home
Making a compost pit for the organic waste to use for your garden
Only allowing sweets with biodegradable wraps or without wraps

5.4.3 Lesson 3 Activity 1 - Cards with different kinds of waste

 Plastic water bottle	
Banana peel	
Paper	
Plastic bag	
Styrofoam box	
Coconut shell	
Tin can	

<p>Empty insecticide bottle</p>	
<p>Fruit peel and leftovers</p>	
<p>Fishbone</p>	
<p>Juice box</p>	
<p>Battery</p>	


5.4.3 Lesson 3 Activity 1 - Name cards: 9 places of common rubbish disposal

Print words on A4 paper or write them on the blackboard

IN THE RIVER OR RIVER BANKS
UNDER THE HOUSE
AROUND THE HOUSE
IN THE POND
ROADSIDE
COMMUNITY DUMPSITE
WASTE BIN
COMPOST PIT
COLLECTION PLACE FOR BURNING

5.4.4 Lesson 4 Activity 2 - Role play cards on plastic bags problem in our village

The amount of sets required is depends upon the amount of student teachers (e.g. if you have 40 student teachers, you'll need 5 sets of 8 role cards). If you can't compile groups of exactly 8 student teachers, you need some double roles in 1 set of cards. It's better to make bigger groups in that case: at least 8 roles should be represented in each group: so if you have 43 student teachers you make 2 groups with 8 student teachers and 3 groups with 9 student teachers (and 1 role is represented twice in these 3 groups).



Village chief: You realise that the huge amount of plastic bags are a serious problem in your village, and you want to change something. The plastic bags are everywhere and are completely destroying the natural beauty of the village. You discuss the problem with the villagers, and try to find the best solution. It is your job to facilitate the discussion.

Villager 1: You complain about the smoke that is caused by burning plastic in most home gardens. Your neighbours burn their plastic at least once a week. The smoke is very annoying but more importantly, your wife is pregnant and you are afraid that the smoke of burnt plastic is hazardous and will harm your baby.

Villager 2: You complain that the roadside in front of your house is used as a dump side and plastic bags are blown away after each storm. They stay in trees and your garden is full of plastic bags, But on the other hand, you admit that you are also a frequent user of plastic bags when you go shopping at the market. But you don't dispose of them at the roadside but bury them in the back garden.

Villager 3: You go to the market and to the grocery shop almost every day. You find that it is very easy that to receive plastic bags to carry your goods. It's easy and you can hang the plastic bags on the steering wheel of your bicycle when driving home. You have no idea how you could carry your goods back home without plastic bags.

Student 1: You are very concerned about the environment. You learnt in school that it takes about 1 million years for a plastic bag to decompose. You think that if we continue like this, there will be no green space in the village anymore. You also want to grow up in a clean village without plastic bags laying at the road side and hanging in trees. You suggest that the only solution is to ban plastic bags in your village. You have many ideas for good alternatives of plastic bags: you can take a re-usable food tray from home if you want to buy snacks at the market or from street vendors, and you can take a shopping basket or a cloth bag when you go to the market.

Student 2: You read on the internet that in Europe most supermarkets are not allowed to provide plastic bags to their customers anymore. It is the law. They gradually started to introduce plastic bag free shopping by charging money for every plastic bag that the customer takes home. This helped to encourage people to reuse plastic bags or to take their own shopping bag to the supermarket. They also sell plastic boxes and reusable bags at the supermarket that make it easy to carry your goods.

Shop keeper: You have a small grocery shop, and you want to provide your customers with the best service, which includes providing them with a plastic bag to carry all their goods. If you don't do that, your customers will go to another shop where they do provide plastic bags. So you have no other choice than to give your customers a plastic bag for each item. You even put every different item (e.g. different kind of fruits) in to separate bags, because customers like it like that.

Market vendor: You sell fruits and vegetables on the market, and you are not happy that all your customers expect to receive a plastic bag for every kind of vegetable or fruit they buy. You spend a lot of money on plastic bags for your customers. And you are also aware that the plastic bags cause a lot of pollution in your village.

5.4.7 Lesson 7 Activity 2 - Examples of observation chart and questionnaire

Observation chart

Describe the water source:			
Location and surroundings	Activities that take place with the water/ around the water source	Users of water source	Pollution?

(Health is not included in the survey observation chart, as it is a difficult topic to observe.)

Questionnaire

Example questions during the interview are:

- What is the water source that is observed?
- Who uses the water source?
- How many times a day?
- For which activities is the water source used?
- Does the location have influence on the water source? How?
- Do people become sick from the water sources? What is the reason?
- Other questions.....

5.4.10 Lesson 10 Activity 2 - Water source cards

water well might contain arsenic substances or rusty substances	pond water is very dirty
community pond	fish raising pond in family
river behind house	pump well support by NGOs
community reservoir	clean water network
manual work of pure drinking water	channel water to irrigate farms
stream	rain water reservoir
water filter	

Water use cards

drinking water	cook rice
have shower	cook meal
clean clothes	clean plate
clean animal	brush teeth
irrigate rice field	dilute chemical pesticide
raise the pigs	water vegetables
vehicles cleaning business	restaurant

6.4.1 Lesson 1 Activity 2- True and False Statements

Below we give some examples of statements; of course you can add some. Try to make them not too obvious - some critical thinking should be involved.

- *“It is not possible to compare different river delta systems as the local context makes ecosystems very different”*
 - **FALSE:** there are many similarities between the ecosystems in river deltas. For this reason the organization who produced this video clip has set up a special committee in order to compare deltas over the world (in this case Mississippi and Mekong) in order to compare and forecast ecological problems due to similar economic development (e.g. dams). Long term consequences of hydropower dams in the United States on the Mississippi delta, can indicate what can happen in the future in the Mekong Delta and Tonle Sap. When these long term consequences can be forecast, there is a possibility to avoid them.
- *“Economic development can have a negative impact on rice production”*
 - **TRUE:** one of the examples of economic development they mention in the video clip is hydropower dams. Damming can disturb the natural cycle of sedimentation and water flow which has a huge impact on the fertility of the soil in the Mekong Region (both Mekong Delta in Vietnam, as Tonle Sap region in Cambodia). Other negative consequences of economic development are activities that cause climate change which also has an impact on the Mekong flow (and consequently rice production and fisheries), in Mekong and Tonle Sap region.
- *“Loss of sedimentation has only a negative impact on rice production as it makes the soil less fertile”*
 - **FALSE:** River sediment is the life blood of delta eco-systems, providing nutrients for agriculture and fisheries and sustaining coastal wetlands. Sediment starvation (caused by e.g. dams, navigation and flood control structures) compounds problems of subsidence or sinking of the ground surface that increases the vulnerability of deltas to sea level rise. Capturing sediment before it reaches the delta can have unintended consequences including land loss, coastal erosion and sinking communities or cities that are more vulnerable to flooding. Most sedimentation comes from the upper Mekong Region (China), which is also where most dams are located. These dams block a big part of the sediment, which causes sediment loss in the lower Mekong region, with consequences for agriculture (loss of nutrients in the soil) and fisheries (loss of nutrients for fish in Mekong AND Tonle Sap).
- *“The main reason for declining fish stocks in Tonle Sap is the lack of water flow into Tonle Sap caused by dams in the upper Mekong Region”*
 - **FALSE:** It certainly is one of the reasons, but the problem of degrading fish habitat and population starts already in the upper Mekong Region as the Mekong provides fish population. Dams can block the migration of fish that is necessary to maintain the fish population in Tonle Sap. Dams not only change the volume of water but also the timing of the flow, which can also impact upon natural ecosystems, such as fish migration. What is not mentioned in the video clip, but which is also a big influence on the decline of fish numbers in Tonle Sap is overfishing and industrial fishing techniques.
- *“Satellite images can help to reduce consequences of global warming”*
 - **TRUE:** satellite based images can be used to monitor ecosystems providing early warnings of droughts or floods or help to track the growth patterns of rice crops. Tools are being developed to monitor ecosystems and forecast the consequences of climate change.

6.4.4 Lesson 4 Activity 2 Role Play Cards on Community Fishery



Fishing Community Chief:

Sok Meoun is a fishing community chief at Tonle Sap Lake. He has been elected as chief for 2 years and his responsibilities are: to form the community members; provide education on protection and fishing in a sustainable way. So far he has tried to advocate that the fishing community conserve flooded forest and avoid illegal fishing. Since the fishing community developed we can see that fish production is increasing and illegal fishing is decreasing because community fishermen understand and have stopped cutting the flooded forest for firewood and instead most of them use a gas stove. The fishermen cooperate well with local authorities and fishing officers.

ADB Representative:

Sela is a project officer working on a project studying livelihood in Tonle Sap, and is funded by ADB. His job is to help the fishing community to provide education on sustainable development; and to provide technical training in order to support their livelihood which depends upon fishing. He teaches youth and community fishermen on how to guide tourists, how to improve transportation services. Eco-tourism can attract tourists to visit the place and can be a very important source of income. He works very hard because he thinks that new jobs for the fishing community will reduce their dependence upon fishing and exploitation of natural resources in Tonle Sap Lake. He wants all the families who live on Tonle Sap Lake to join as fishing community members.

Family Fisherman

Mrs Suy's family has been a fisherman on Tonle Sap Lake for 15 years. There are nine family members in her family and among those, 5 are students. 10 years ago, she and her husband were able to catch fish from 50 to 100 kilos in one night. They could easily support their family. Today, however, fishermen have to go far away from their homes because the places that they used to fish have become private fishing plots. The fishing is more difficult and sometimes they catch only 10 kilos, because of the increase in the number of fishermen, and the added burden of illegal fishing methods. She wants all fishermen to agree to stop using illegal fishing methods. She doesn't want her children to become fishermen like them so they encourage their children to get an education so they may find a good job.

Fisherman who used to fish in illegal way

Mr Soka is 30 and he used to fish using illegal methods. Before he became a community fishing member, he fished using illegal methods for a long time, but now he has stopped, because he participated in training about the development of a fishing community. It made him understand the importance of protecting flooded forest and he created a guard group to prevent illegal fishing. He wants authority officers not to take bribes from businessmen and to take legal measures against those who commit illegal fishing acts. He believes that will cause illegal fishing to decrease.

Fisherman

Mr Kong is a fisherman in the community and has an average living standard. He always uses illegal fishing methods to catch fish especially in the reproductive season. He thinks that it is normal to use these methods because if he doesn't use them, he cannot catch fish. Sometimes he pays fishing officers so that he can fish whatever he wants. He thinks that if there is no corruption the fish conservation is more effective. When everyone else stops fishing using illegal methods, then he will too.

Authority Officers:

Sovann and Heang are police officers and they expressed their ideas as below:

1. Fishing may only take place at set times and it is forbidden to use illegal fishing methods.
2. Daily generation of waste or kitchen waste have to be kept in proper places and biodegradable waste should be put into compost to use with our vegetables.
3. All of us have to participate to protect flooded forest and the cutting down of trees for firewood is subject to community regulation to prevent fires from occurring in the dry season.
4. Grow trees in the flooded forest
5. Inform authorities if you see illegal fishing, hunting, or logging of the flooded forest
6. Promote and spread information to other villagers who are not aware of and the project to conserve our Tonle Sap environment.

School Director:

Mr Chea Mab is a primary school director in the local community and he mentioned regarding the Tonle Sap Lake the problems as follows: In the last few years, there have been logging of the flooded forest and illegal fishing activities, and an increase in the number of fishermen from year to year which has caused family fishing to be more difficult now. In my school, all teachers have been integrating environmental lessons about Tonle Sap Lake at least 2 hours per week. This helps students understand and participate in protecting and conserving our Tonle Sap Lake environment and to help reduce negative consequences from damage that our community has caused. Besides that, we have also become involved in helping the community to work as a community. Therefore, environmental education is very important for our children.

Commune Chief:

He has cooperated closely with expert officers and strongly supports the fishing community. Today he would like to thank very much all the people involved in community development for good cooperation so far. He requests that everyone continue cooperating well and to participate even more in order to make the fishing community even more successful.

Primary School Student:

Sophy is a grade 6 student and she gives her ideas as follows: Currently her school doesn't have a good environment. The school director should put more waste bins and avoid throwing waste into the water. If there is no action, disposing of waste into the water every day will pollute the water and it will frustrate the feeling of tourists who come to visit.

Fishing Plot Owner:

In fact Mr Seng is a businessman also wants to join our community in protecting our Tonle Sap Lake environment. He thinks that in order to conserve fish, we have to respect each other by not fishing at forbidden plots and respecting the rules. He also releases young fish into the lake to reproduce. He hopes that we will continue to cooperate with each other closely and as such, help prevent illegal fishing.

Fishing Officer:

Mr Thann is a fishing officer and he has authority to implement fishing regulation, forbid fishing in the reproductive season, and file complaints to the court for illegal fishing or logging in the flooded forest in this jurisdiction.

List of multimedia

DVD nr 1 and nr 2 Documentary clips

DVD	Chapter/lesson	Title Documentary Video clip	Source
	Chapter 1 Introduction to Environment		
	None		
	Chapter 2 Biodiversity and Ecosystems		
DVD 1	2.4.1 Lesson 1 Biodiversity	Extra activity 1 Natural resources conservation	BCI
DVD 1	2.4.1 Lesson 1 Biodiversity	Extra activity 2 Protection and naming of vegetation	TVK
	Chapter 3 Natural resources and Impact of Overuse		
DVD 1	3.4.2 Lesson 2 Deforestation	Activity 2 Community Based Eco Tourism at Chambok	TVK
DVD 1	3.4.3 Lesson 3 Wildlife	Activity 3 Wildlife conservation	TVK
DVD 1	3.4.4 Lesson 4 Mining Resources	Activity 3 Mining investment in Mondulkiri Province	TVK
DVD 1	3.4.5 Lesson 5 Climate change	Extra activity Global warming	TVK
	Chapter 4 Waste management at PTTC, school, community		
DVD 1	4.4.4 Lesson 4 The 3 R's	Activity 3 Waste – not waste	TVK
DVD 1	4.4.8 Lesson 8 Waste Campaign	Waste Campaign	VVOB SEAL
	Chapter 5 Pollution in Cambodia		
DVD 2	5.4.1 Lesson 1 Air pollution	Activity 1 Air and noise pollution	TVK
DVD 2	5.4.1 Lesson 1 Air pollution	Activity 3 Air Pollution	TVK
DVD 2	5.4.4 Lesson 4 Plastic bag problem in our village	Activity 1 Plastic bags used in Cambodia	TVK
DVD 2	5.4.5 Lesson 5 The importance of water	Activity 3 Use of ceramic water filter	IBE
DVD 2	5.4.6 Lesson 6 Polluted and clean river	Activity 2 Clean drinking water	Ministry of Health
DVD 2	5.4.8 Lesson 8 Reporting on survey water sources	Activity 2 Water consumption	TVK
DVD 2	5.4.10 Lesson 10 Safe water consumption	Activity 3 Arsenic water consumption	TVK
	Chapter 6 Environment of River		
DVD 2	6.4.1 Lesson 1 The importance of Mekong River	Activity 1 Forecast Mekong	USGS
DVD 2	6.4.1 Lesson 1 The importance of Mekong River	Extra activity Save the Irrawaddy Dolphin in Mekong	TVK
DVD 2	6.4.3 Lesson 3 Illegal fishing	Activity 2 Lack of fish in the Tonle Sap	TVK
DVD 2	6.4.4 Lesson 4 Tonle Sap Lake conservation	Activity 1 Save Our Great Lake	ADB WATER

**Disc 3 Flash animation, PowerPoints, Maps and Photos/slides**

DVD	Chapter/lesson	Title clip	Source
	Chapter 2 Biodiversity and Ecosystems		
Disc 3	2.4.2 Lesson 2 Ecosystems and wetlands	Activity 3 Wetland Map	SCW
	Chapter 3 Natural resources and Impact of Overuse		
Disc 3	3.4.5 Lesson 5 Climate Change	Activity 1 Flash animation on Climate Change	
	Chapter 5		
Disc 3	5.4.9 Lesson 9 Water cycle and environment	Activity 2 PowerPoint on the Water Cycle	VVOB SEAL

**DVD nr. 4 to nr. 7 Demonstration of Teaching Activities**

DVD	Chapter/lesson	Title clip	Source
	Chapter 1 Introduction to Environment		
DVD 4	1.4.2 Lesson 2 Education for Sustainable Development	Activity 2 Group discussion on case study	VVOB/ Open Institute
	Chapter 2 Biodiversity and Ecosystems		
DVD 4	2.4.1 Lesson 1 Biodiversity	Activity 2 Educational Game Web of Life	VVOB/ Open Institute
	Chapter 3 Natural Resources and Impact of Overuse		
DVD 4	3.4.2 Lesson 2 Deforestation	Activity 3 Role play reforestation	VVOB/ Open Institute
DVD 4	3.4.3 Lesson 3 Wildlife	Activity 1 Educational game Endangered Species	VVOB/ Open Institute
	Chapter 4 Waste management at PTTC, schools and community		
DVD 5	4.4.1 Lesson 1 Different kinds of waste	Activity 2 Group work on community and home survey	VVOB/ Open Institute
DVD 5	4.4.3 Lesson 3 Bio-degradable and non-bio-degradable waste	Activity 1 Forget me not	VVOB/ Open Institute
DVD 5	4.4.3 Lesson 3 Bio-degradable and non-bio-degradable waste	Activity 3 Life Time	VVOB/ Open Institute
DVD 5	4.4.4 Lesson 4 The 3 R's	Activity 2 School waste audit	VVOB/ Open Institute
DVD 5	4.4.5 Lesson 5 Survey on plastic bag use in school	Activity 2 Plastic bag free school	VVOB/ Open Institute
DVD 5	4.4.6 Lesson 6 Waste	Extra activity Educational game Use and Throw	VVOB/ Open Institute
	Chapter 5 Pollution in Cambodia		
DVD 6	5.4.1 Lesson 1 Air pollution	Activity 2 Finding partner game	VVOB/ Open Institute
DVD 6	5.4.2 Lesson 2 Waste disposal in Cambodia	Activity 1 Making waste decisions	VVOB/ Open Institute
DVD 6	5.4.3 Lesson 3 Waste disposal	Activity 2 Educational game Waste disposal	VVOB/ Open Institute

DVD 6	5.4.5 Lesson 5 The importance of water	Activity 1 The water and I	VVOB/ Open Institute
DVD 6	5.4.5 Lesson 5 The importance of water	Activity 2 Group discussion on polluted river poster	VVOB/ Open Institute
DVD 6	5.4.6 Lesson 6 Polluted and clean river	Activity 1 How to use polluted and clean river poster	VVOB/ Open Institute
DVD 7	5.4.7 Lesson 7 Preparation on survey water sources	Activity 1 Educational game Oh deer	VVOB/ Open Institute
DVD 7	5.4.9 Lesson 9 Water cycle and environment	Activity 1 How much water for us	VVOB/ Open Institute
DVD 7	5.4.9 Lesson 9 Water cycle and environment	Activity 3 Water cycle experiment	VVOB/ Open Institute
DVD 7	5.4.11 Lesson 11 Extra activity on art work	Activity 1 Water drawings	VVOB/ Open Institute
	Chapter 6 River Environment		
DVD 7	6.4.2 Lesson 2 Consequences of hydro dams	Activity 1 Educational Game Dams and Fish	VVOB/ Open Institute

List of pictures

Picture	Title	Source
Picture 1	Case study using egg drawing	VVOB SEAL 2011
Picture 2	Ecosystem	Copyright © Live & Learn
Picture 3	Forest in O Svay	VVOB SEAL 2011
Picture 4	Forest in Mondulkiri	VVOB SEAL 2011
Picture 5	Deforestation and reforestation	Copyright © Live & Learn
Picture 6	Drought	Copyright © Live & Learn
Picture 7	Flood	Copyright © Live & Learn
Picture 8	Waste management in school	Copyright © Live & Learn
Picture 9	Poster Polluted and Clean village	Copyright © Live & Learn
Picture 10	River pollution	VVOB SEAL 2011
Picture 11	Teaching aids made by plastic waste	VVOB SEAL 2011
Picture 12	School waste campaign in community	VVOB SEAL 2011
Picture 13	Segregating waste	VVOB SEAL 2011
Picture 14	Poster Polluted River	Copyright © Live & Learn
Picture 15	Poster Polluted and Clean River	Copyright © Live & Learn
Picture 16	Experiment on water cycle	VVOB SEAL 2011
Picture 17	Experiment on water cycle	VVOB SEAL 2011
Picture 18	Experiment on erosion	VVOB SEAL 2011
Picture 19	Flooded forest in Tonle Sap Lake	Copyright © Osmose
Picture 20	Fishing at Tonle Sap Lake	Copyright © Osmose
Picture 21	Outline map	Save Cambodia's Wildlife 2006, Atlas of Cambodia
Picture 22	Wetland map	Save Cambodia's Wildlife 2006, Atlas of Cambodia

List of posters

Title of poster	Lesson	Sources
Endangered bird species	3.4.3 Lesson 3 Activity 1	Copyright © Osmose
Causes of Global Warming	3.4.5 Lesson 5 Activity 1	Heyworth, R.M. & Briggs, J. G. R., 2007, Chemistry Insights , Pearson Longman, 2nd edition.
Polluted and Clean Village	4.4.1 Lesson 1 Activity 1	Copyright © Live & Learn
Polluted River	5.4.5 Lesson 5 Activity 2	Copyright © Live & Learn
Polluted and Clean River	5.4.6 Lesson 6 Activity 1	Copyright © Live & Learn
Water Cycle	5.4.9 Lesson 9 Activity 3	Strahler, A. & Strahler, A. (1992) Modern Physical Geography, Wiley, 4 th Edition, p485
Tonle Sap Lake Ecosystem	6.4.4 Lesson 4 Activity 1	Copyright © Osmose
Use of the flooded forest	6.4.4 Lesson 4 Activity 2	Copyright © Osmose

References

Books

The Atlas of Cambodia, National Poverty and Environment maps, Save Cambodia's Wildlife with support from Danida Phnom Penh, 2006

Earth Science and Environment book, grade 11, MoEYS, published in 2008

Earth Science and Environment book, grade 12, MoEYS, published in 2011

Environmental Education Handbook, Teacher's Resource, Standards VI-VIII, Centre for Environment Education (CEE) India, 2005.

Activities from "Environmental Education Handbook" copyrights © 2005:

- Who am I? (page 11)
- Web of life (page 25)
- How much water for us? (page 40)
- Forget me not (page 81)
- Life time (page 82)
- Use and throw (page 85)
- School compost pit (page 182)
- Plastic bag free school (page 184)

Environmental Education for Primary School level, Committee of Inter ministry focussing on Environmental Education, published by Department of Environmental Education Information and Extension, 2005

Environment Education Handbook: Understanding our environment, Ministry of Environment (2008).

Environment Manual, compiled, revised, verified and edited by Noel Lou Brian (English version) and Mr. Ponlork (Khmer version 2000)

Green games, Centre for Environment Education (CEE) India, copyrights © 1997

Activity from "Green games" third edition 2006:

- Oh deer (page 15)

Fundamentals of Environment, compiled and translated in Khmer by Mr. Sporn Vin, July 2003

Lextionary for forestry, Mr.Ouk Siphon, department of agricultural legalisation of Ministry of Agriculture, Forestry and Fishery, 2008

Manual guide for teachers on Tonle Sap Lake Environmental Education, cooperation between MoEYS and Live & Learn, published in 2006

Policy for Curriculum Development 2005-2009, Ministry of Education, Youth and Sport Safety of Land use, grade 9, organised by Ministry of Education Youth and Sport, ECOSORN 2009

Science book, biology and earth science, grade 7, MoEYS, published in 2007

Science book, grade 8, MoEYS published in 2010

Science book, biology and earth science, grade 9, MoEYS, published in 2008

Science book, biology and earth science, grade 10, MoEYS, published in 2007
Teacher's book for Environment Educator, prepared by MoEYS in cooperation with Osmose, Mlub Baitong, FAO, Sam Veasna Center (SVC), Save Cambodia's Wildlife (SCW), copyright 2007, second publication.

Understanding Climate Change, Manual for secondary schools, Department of Climate Change, Ministry of Environment, 2001.

Understanding Environment, Chokar Kiran B., Pandya M., Rachunathan M., Centre for Environment Education, 2004

Webpages with organisation as author

<http://www.forteachersforstudents.com.au/ClimateChange>

<http://www.globaltrade.net/international-trade-import-exports/f/market-research/pdf/Cambodia/Mining-and-Quarrying-Mining-Support-Services-Mining-sector-in-Cambodia.html> (*Sector Report - Mining in Cambodia 2009, produced by Reingsey Oum, Trade and Investment Officer, British Embassy Phnom Penh*)

<http://minerals.usgs.gov/minerals/pubs/country/2009/myb3-2009-cb.pdf>
Mineral Yearbook-Cambodia 2009, USGS

http://wwf.panda.org/what_we_do/foodprint/water/dams_initiative

<http://www.recoftc.org/site/Community-Forestry-in-Cambodia>

<http://www.unesco.org/csi/pub/papers3/sande3.htm>

<http://www.unescobkk.org/education/esd-unit/characteristics-of-esd>

<http://www.unicef.org/lifeskills>