



# Teaching Manual for Mangrove Education

(Teaching Material for 6 Hours / Lessons)

## > ELEMENTARY SCHOOLS <



## ELEMENTARY SCHOOL - Plan for at least six lessons on mangroves

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The following table gives you an overview on the topics of mangrove education and the exercises, worksheets and inputs you can use from the [education kit](#) to teach it. Going through all these exercises in grades 5 and 6 will take you approximately five to six hours. Feel free to change and modify this lesson plan at any time and ask the students for their feedback!

<b>1. introduction</b>	Exercise 16 - Visualizing the Topic with the Help of Pictures Input I (2.2)* - Mangrove forests ecosystem (2.2) Exercise 17 - No One Likes Salty Water - Except for Mangroves Worksheet 4 a) - What is a mangrove?
<b>2. benefits of mangroves</b>	Input II (2.2.1) - Why do we need mangroves? (2.2.1) Worksheet 1 a) + b) - Have you ever seen a mangrove? / Benefits of mangroves Exercise 9 - The tree of life Exercise 6 - The ocean-bowl experiment Exercise 7 - Wind versus mangroves Exercise 5 - Everything is connected
<b>3. mangroves in danger</b>	Input III (2.2.2) - An ecosystem under threat (2.2.2) Worksheet 2 a) + b) - Where do mangroves grow? / Something has changed Exercise 4 - Changing environment Exercise 8 - Waste and a seedling
<b>4. getting involved</b>	Input IV (3.1) - Conservation and protection (3.1) Exercise 15 - What Comes Next? - Steps for Reforestation Input V (3.2) - Experience from San Agustin (3.2) Worksheet 4 b) - What Can I Do? Exercise 12 - What Can I Do? - Finding Solution Exercise 18 - Visual Summary - Create a Poster for Class
<b>5. evaluation</b>	<ul style="list-style-type: none"><li>▪ A short test on the topic to check the students' understanding</li><li>▪ General discussion and open questions</li><li>▪ Comments from the students: What did they like? / What did they not like?</li><li>▪ Interest: Do students want to learn more about mangroves and get involved?</li><li>▪ Feedback from teachers and other persons involved</li></ul>




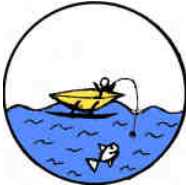



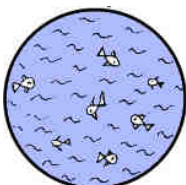

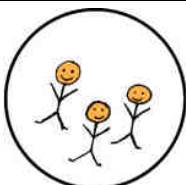
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<b>Material needed</b>	<ul style="list-style-type: none"><li>▪ worksheets 1; 2 and 4</li><li>▪ big paper, normal paper, markers and pens, cardboard in green and different colours, strong cardboard, scissors, tape</li><li>▪ a transparent plastic bowl or box, plastic bags, box</li><li>▪ string straw rolls</li><li>▪ sand and water</li><li>▪ mangrove seedlings from a nursery</li><li>▪ various pictures from mangroves, their environment, benefits and threats</li><li>▪ two bottles of water, glasses and salt</li></ul>
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\* Numbers in () refer to the chapters used in the mangrove education kit.

## English - Romblomanon

*This translation provides the Romblomanon words for some important English terms in mangrove education. This will help to increase the students' understanding.*

Ecosystem Mangroves		Threats to Mangroves			
	bird brackish water environment food freshwater habitat purification salt / salty soil shellfish species	pis-pis alat tabang palibot pagkaon tubig pamayay paglimpyo asin / ma-asin duta kayog klasi		damage destroy diseases firewood fishpond plastic bags pollute (v) threat waste	guba (n) / distrosa (v) sira-on sakit kahoy palaisdaan plastik bag higko hadlok basura
The Weather		Fishing			
	climate rain (v/n) storm typhoon weather wind	klima uyan bagyo bagyo panahon hangon		boat (paddle) boat (motor) dynamite fishing bouy fish (n) / (v) fishcage fishnet overfishing	baroto motor pag gamit ng dilameta buya isda / bunit likom pukot sobrang parging isda
The Mangrove Tree		Raising Awareness			
	leaf / leaves mangrove plant (n/v) root seed seedling	dahon bakawan tanum gamot busoy tubo-an		awareness education educate maintain monitoring	pag-aman educasyon tudloan mintenar pag aubay-bay
Conservation and Protection		In the Sea			
	conservation nursery protect (v) reforestation sanctuary	pag-plaga punlaan protektahan pagtanom sanktuaryo		coral reef low tide high tide surface waves	koral hunas taob ibabaw humback
Coastal Communities		Human Activities			
	building coast community construct dike erosion house	bilding baybayon komunidad human diki panas bayay		farm (n) fishing plant (v) swimming	uma pagbunit tanum langoy

# Worksheets - Questions and Suggested Answers

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## Worksheet 1

**a) *Have you ever seen mangroves?***

The students' answers may vary here. If they have seen mangroves, talk about roots, leaves, other species around and the environment they live in. If they haven't seen any, let them think about why this is the case? Do they live near the coast? If so, what is the environment like?

**b) *Trees of life***

Some possible answers:

- Mangroves protect coastline from erosion and floods
- Young fish need the mangroves to grow up
- Many species get their food in mangrove forests
- Mangroves are a rich source of fishery products
- Mangroves are a source of firewood
- Mangroves protect houses from storms and flooding

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## Worksheet 2

**a) *What does a mangrove look like and where does it grow?***

Students can draw their tree in the middle of the paper - partly under water. Explain that various mangrove species exist under different conditions. Focus attention to roots and the leaves; and discuss with the students what the ideal environment of a mangrove should be like.

**b) *Something has changed...***

- (1) more houses / (2) a dike / (3) less birds /  
(4) dead mangroves / (5) less fish / (6) sea level rise

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## Worksheet 3

**a) *One coastline - many ecosystems***

- Mangroves: prevents erosion / nursery area / pollution sink
- Sea-grass: nursery feeding area / stops sediments
- Coral Reef: habitat for many fish / buffer for shoreline

**b) *What happens when...***

No mangroves = no protection from storm, erosion, floods / fish lose nursery  
No sea-grass = sediments reach coral reefs, strong waves damage mangroves  
No coral reefs = Fish lose their habitat / increased erosion

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## Worksheet 4

**a) *What is a mangrove?***

1. Mangrove forests grow at the margins of tropical and subtropical coastlines around the world. They grow in saline coastal habitats.
2. Mangroves need slow currents, no frost and plenty of fine sediment for root attachment. They grow in brackish water.
3. Mangroves provide habitat and food for other species. They are a nursery for fish. Mangroves clean the water, prevent the coastline from erosion and human settlements from destruction.

**b) *What can I do?***

- Keep the water clean! - Don't dump your waste into the sea.
  - Look for the planting sites! - Keep them clean, protect them from animals.
  - Watch the mangroves! - Monitor their growth and survival.
  - Talk to people! - Confront them with the benefits of mangroves.
  - Get involved! - Help planting and maintaining the mangroves.
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## Evaluation - Feedback Sheet

*The reason for doing workshops on mangrove education is to let you know more about this fascinating ecosystem. To improve our workshops we want to know what you liked and what not. Now it's up to you! Please give us your feedback!*

### 1) How did you like the workshop?

The workshop consisted of different parts with various activities. Tick what expresses best your feelings and thoughts about the following components. Make only one tick in each line!

	😊😊 very much.	😊😐 only a bit.	😐😐 not really.	😐😞 not at all.
1.1) I liked the different experiments...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1.2) I liked the activities outside the room...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1.3) I liked the lectures and inputs...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Look at the following statements and indicate if you agree or not.

	😊 (agree)	😐	(disagree) 😞
1.4) I could follow the workshop easily.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1.5) I learned new facts about mangroves.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1.6) I want to learn more about mangroves.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

1.7) My favourite exercise: \_\_\_\_\_

1.8) This was the worst part: \_\_\_\_\_

1.9) This was easy to understand: \_\_\_\_\_

1.10) I had problems to understand: \_\_\_\_\_

### 2) What do you want to learn more about?

*I want to learn more about...*

2.1) ...the mangrove forests ecosystem in general.....	<input type="checkbox"/>
2.2) ...the benefits of mangroves.....	<input type="checkbox"/>
2.3) ...the threats mangroves are exposed to.....	<input type="checkbox"/>
2.4) ...how I can get involved to protect mangroves.....	<input type="checkbox"/>
2.5) ...anything else about mangroves (please specify!!!)	<input type="checkbox"/> _____

### 3) Any other Comments!?

*Is there anything you heard about in the workshop you would like to learn more about?*

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

①

# Introduction

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Copy or print the following pages from the [education kit](#) for this section:

- page 69 (Exercise 16 - Visualizing the Topic with the Help of Pictures)
  - page 70 (Exercise 17 - No One Likes Salty Water - Except for Mangroves)
  - page 50 (Worksheet # 4 - a) only!
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## ⇒ Input I - Mangrove Forests Ecosystems

- mangroves are very important trees along the coastlines around the world
- very fascinating and special: only trees growing in salty water
- We all need them! - protect our homes from storms and are home to many fish
- ***This workshop will bring you closer to the mangroves!***

*Let one or two students come in front and let them draw a mangrove on paper or the blackboard!*

- Together we will learn...
- What mangroves actually are,
  - Why we need mangroves,
  - What is dangerous for them and
  - How all of you can protect and help the mangroves

*ARE YOU READY???*

***Exercise 16 comes here!***

- Mangroves not only in the Philippines --> grow all over the world in tropical /subtropical areas
- They all look different --> size, leaves, roots etc. (1,5 to 30 meters high)
- Reason: adaptation to the environment and certain conditions (water, soil etc.)
- Estimated, that about 70 mangrove species exist around the world
- Definition: “Mangrove forests are tree wetlands located on the coastlines in tropical climates.”
- Mangroves grow on almost every substrate (rocks, sand, broken corals)
- On shorelines and riverbanks close to the sea
- This is important:
  - Warm tropical temperature all year round
  - Moderate freshwater
  - Regular surface-water flushing
- One is very important: - Salty or **brackish water** (no other plant can do this)

*Explain and visualize “brackish water” (fresh meets salty water)*

***Exercise 17 comes here!***

- How do mangroves survive under these extreme living conditions?
  - o Mangroves storage water in leaves // seeds develop on the mature tree (already seedlings)
  - o Roots can filter the salt from the water to keep it outside the plant
  - o Roots grow from the ground upwards to reach the surface to breath (up to three meters)
- Mangroves are a unique ecosystem - many, many species depend on them, including us!

*Explain “ecosystem”! (all animals and plants in a certain area + their interaction, e.g. pond, dessert)*

***Worksheet 4 a) comes here!***

②

# Benefits of Mangroves

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Copy or print the following pages from the [education kit](#) for this section:

- page 47 (Worksheet # 1)
  - page 62 (Exercise 09 - The Tree of Life)
  - page 59 (Exercise 06 - Erosion: The Ocean-bowl Experiment)
  - page 60 (Exercise 07 - Wind Versus Mangroves)
  - page 58 (Exercise 05 - Everything is Connected)
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## ⇒ Input II - Why do we Need Mangroves?

- What does a mangrove look like? Think about leaves, roots etc. - Have you ever seen a mangrove?

**Worksheet 1 a) comes here!**

- Mangroves are a **multi-function resource**
- >>> many, many benefits both for the environment (1) and for us (2)

*Find the benefits together with the class - based on the benefits learned in the introduction)*

- Ecological importance (1):
- Mangroves filter coastal water and help to keep it clean
  - Mangroves protect coasts from storms and floods
  - Important feeding site for fish and other species
  - Function as a nursery for fish (1.08t fish per 1ha mangroves/year)

*Visualize a hectare! (100m x 100m = 10.000m<sup>2</sup>) - How many classrooms fit in there?*

- Play an important role in the **food chain** (leaves, crabs, fish etc.)

*Explain "food chain", give a visual example. (Algae on roots, shellfish, small fish, bigger fish, bird)*

- Important for people (2):
- Resource for typical forests' products such as firewood
  - Mangroves protect human settlements from storms and typhoons
  - Rich source of fishery products and shellfish (**nursery**)

*Explain "nursery"! (Young fish can hide and grow up in mangroves before living elsewhere.)*

**Worksheet 1 b) comes here!**

**Exercise 09 comes here!**

**Exercise 06 comes here!**

**Exercise 07 comes here!**

**Exercise 05 comes here!**

③

# Mangroves in Danger

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Copy or print the following pages from the [education kit](#) for this section:

- page 48 (Worksheet # 2)
  - page 57 (Exercise 04 - Changing Environment)
  - page 61 (Exercise 08 - I need protection! Waste and a Seedling)
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## ⇒ Input III - An Ecosystem Under Threat

- Mangroves in almost every tropical and subtropical country
- But what do they look like and where do mangroves usually grow?

*Worksheet 2 a) and b) both come here!*

- BUT: 50% lost during the last years // in the Philippines even 75% from 1918 to 1995
- Decline from 500.000ha to 117.000ha during this time; still getting less!

*Let the students simply visualize the decline on the blackboard, e.g. by drawing 12 (6 / 4) dots.*

- Why is this the case and where are all the mangroves gone?
- Reasons mostly because of human destruction and interference
  
- direct human intervention:
  - Housing and infrastructure projects close to the shoreline
  - Pollution and siltation (water gets saltier)
  - Dikes and other constructions on the shoreline
  - Overexploitation (e.g. for firewood)
  - Conversion of mangrove forests into large **fishponds**  
(productive only for three to five years, useless because of many chemicals / even mangrove reforestation not possible)
  
- indirect (natural) threats:
  - Pests and diseases
  - Typhoons and very strong storms
  - Sea-level rise due to climate change
  
- >>> Natural threats become more frequently and stronger because of **human activities!**

*Exercises 04 and 08 come here!*

# ④

## Getting Involved

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Copy or print the following pages from the [education kit](#) for this section:

- page 68 (Exercise 15 - What Comes Next? - Steps for Reforestation)
  - page 50 (Worksheet # 4 - b) only!
  - page 65 (Exercise 12 - What Can I Do? - Finding Solutions)
  - page 72 (Exercise 18 - Visual Summary - Create a Poster for Class)
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## ⇒ Input IV - Conservation and Protection

- Mangroves produce many seeds - easily re-establish after natural threats like storms
- But: **Natural Regeneration** not enough to compensate massive human destruction
- >>> That is why: **Reforestation Projects** all over the world, especially in the Philippines
- *Mangrove reforestation takes place where natural regeneration has failed!*

*Explain the difference between natural regeneration and reforestation projects.*

- Why reforestation?
  - 1) To regain mangrove ecosystem's services (nursery, food chain...)
  - 2) To protect coastal areas from destruction, storms, erosion etc.
  - 3) To restore a natural resource to use it in a sustainable way
- Advantages:
  - Most appropriate species can be selected for planting
  - Number and distance of seedlings can be easily regulated
  - Heavily destructed areas can be restored easier and faster
- Disadvantages
  - Hard to restore a forest that will be similar to the original one
  - Reforestation is expensive and labour-intensive
  - Projects are likely to fail because of many reasons and factors
- Reasons for failure can be varying greatly; in general, 95 percent of all projects fail!!!
- Only 50 out of 1,000 planted mangrove seedlings survive!
  - o Mangroves are planted in areas where there have never been mangroves before (sounds stupid, but is unfortunately true especially for the Philippines)
  - o Only "Rhizophora" planted > easy to handle, but needs certain conditions!
  - o Wrong species for the natural conditions (no knowledge about former mangroves)
  - o Concentration on mangrove planting! (community not involved, no monitoring)

*Be creative and try to visualize each of these reasons on the blackboard. After every type of failure **get the class involved** and ask them what they would do instead.*

- >>> *Implementing a mangrove reforestation is much more than only planting mangroves!*

*Exercise 15 comes here!*

### Steps needed for Reforestation

- Step 1: Get informed and inform the community!
- Step 2: Mobilize locals for stronger support!
- Step 3: Collect information on the planting site!
- Step 4: Choose what species fits best!

- Step 5: Collect seeds /grow seedlings in a nursery!
- Step 6: Plant the mangrove seedlings!
- Step 7: Maintain and monitor the project site!
- Step 8: Learn lessons and adjust the project!

## ⇒ Input VII - Experience from San Agustin

- Three questions have to be considered when planning a mangrove reforestation project:
  - o 1) Have there ever been mangroves before at the project site?
  - o 2) What are the conditions like and what species would grow best under these conditions (substrate, low tide and high tide, intensity of the sun etc.)?
  - o 3) Do the coastal communities acknowledge and support reforestation activities?

*Ask the students what they think the situation is like in San Agustin and then proceed.*

- Various mangrove sites and reforestation projects on Tablas Island and around San Agustin
- Many organisations and people support this (locals, the Agricultural Department in San Agustin, foreign volunteers etc.)
- But above all: fishermen (mangroves as breeding area for fish), shellfish gatherers (mangroves as feeding area) and people living near the coast (protection from storms)

*Ask if some of the students' parents are fishermen or involved in mangroves in any other way.*

- What is special about San Agustin?
  - o There are no brackish water fishponds (60% of all mangrove destruction in the Philippines)
  - o Most mangroves lost for firewood and charcoal
  - o Especially riverbank mangroves were cut down on Tablas (made responsible for floods because mangroves hold sediments back in the rivers)
  - o The island is a typhoon prone area!!! (make reference to **typhoon Frank 2008**)

### **Successes!!! :-)**

- Establishment of a Marine Sanctuary (2002)
- Raised awareness of the local communities
- Some locals with close relationship to mangroves

### **Failures :-)**

- Animal grazing (goats)
- Poor location choice for seedlings
- Fishermen cut down mangroves for access points
- Waste destroys mangroves and seedlings

*Draw the symbols “:-)” and “:-)” on the blackboard, say any success or failure and let the students decide where to put the argument. Discuss it afterwards.*

**Worksheet 4 b) comes here!**

- Community involvement very important! - Everyone can support the project!
- When people know the benefits of mangroves, it is more likely that they will protect them!!!

**Exercises 12 and 18 come here!**

**The Feedback Sheet comes here!!!**