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# PACIFIC LOW ISLAND ENVIRONMENTS

Place-based resources for Pacific Island schools



## DEDICATION

*For students, teachers and communities  
living in tropical Pacific island environments.*

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# INTRODUCTION

There are two main kinds of islands in the Pacific Ocean: high islands and low islands. All islands where people live have some of the same **environments** (kinds of places such as coral reef, open ocean, and forest). Some islands have unique places that are not on all the other islands.

This book describes different environments on Pacific low islands. This book has pictures of these environments, and the plants and animals that live there. See how many of these environments you know about. You can also read the high island book that describes other environments such as upland forests and caves.

These islands are in the Pacific Ocean near the equator. Because of this location, the islands have a warm **climate**. It is warm for the whole year. It is warm during the day and warm during the night. The ocean is warm all year. This warm climate is different from the climate in many other parts of the planet. Many of the plants and animals that live here are different from the plants and animals that live in colder parts of the planet.

The words that are in brown might be new words in English for you to know. Check out the Glossary near the back of the book where you can learn what each of these words mean. We write these words in brown the first time they are in the book.

This book has pictures of plants and animals that live on low islands. How many of the plants and animals do you already know? What plants and animals do you see on the island that are not in the book? Talk with your friends, family and teachers to find out what they know about the environments, plants and animals on your island home.



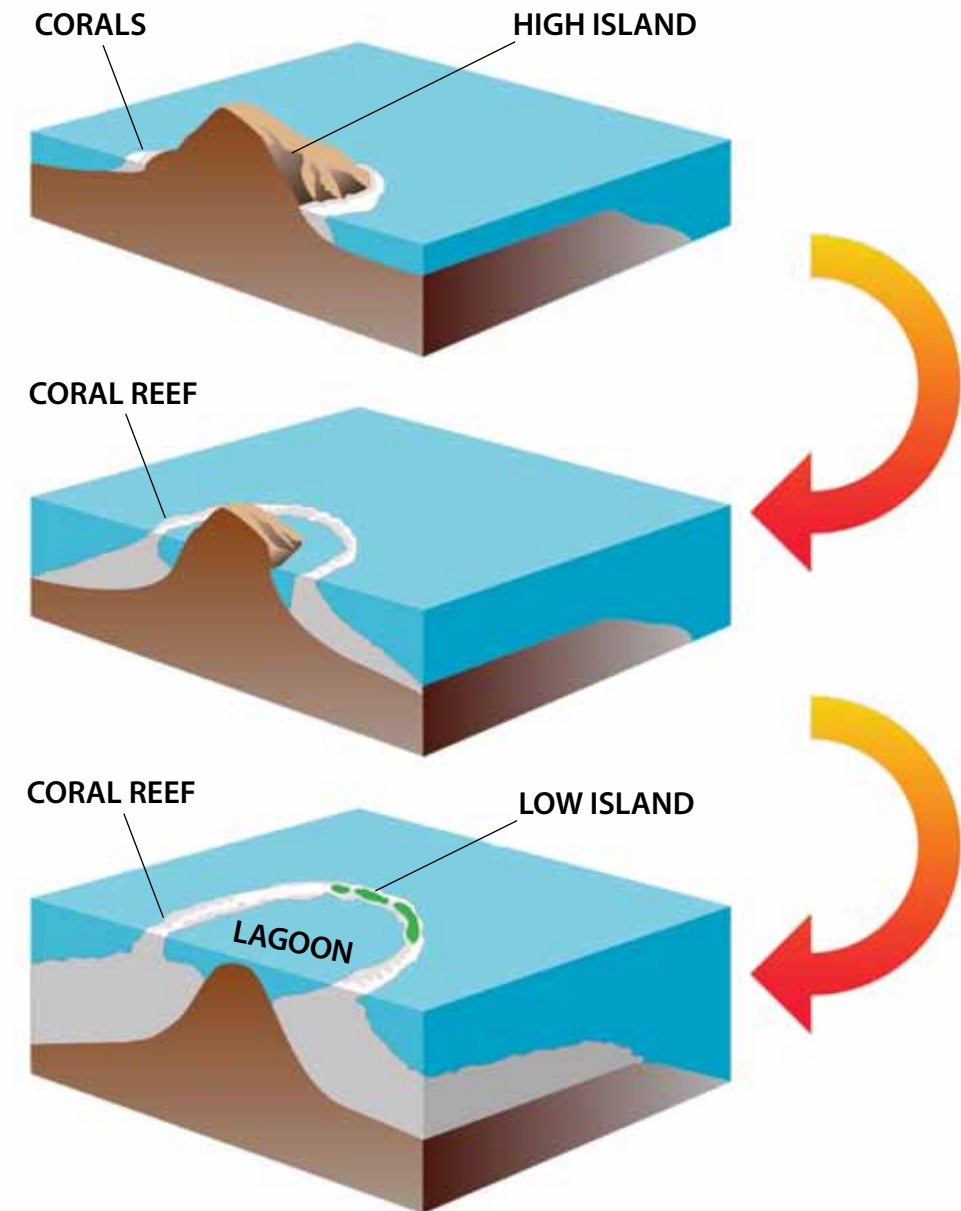
# WHAT IS A LOW ISLAND?

Low islands in the Pacific Ocean that are far from continents started as underwater volcanoes. The **lava** from the volcano rose above the ocean surface and became an island with high hills or mountains. Because such islands usually rise high above the ocean, we call them high islands. The top picture shows a high island that is surrounded by a coral reef.

Over millions of years, a high island can become lower and lower, and then disappear below the water. The middle picture shows that as the high island gets lower, coral reefs can still grow around it in a ring-like shape. Even after the original island has been gone for a very long time (bottom picture), the coral of the surrounding reefs keeps growing and stays near sea level. A reef shaped like a ring and the lagoon that it surrounds are called an **atoll**. An atoll is shaped like the coast of the original high island that disappeared.

Some places on top of the ring-shaped reef can become low islands. These low islands begin as piles of sand and rocks that are pieces of dead coral and shells of other ocean **organisms**. Over time, the piles keep growing and become small islands. These small islands are very different from high islands. The small atoll islands are usually narrow and flat, with no hills or mountains. Since these atoll islands rise very little above the ocean surface, we call them low islands.

## BIRTH OF A LOW ISLAND



# WHAT ARE LOW ISLAND ENVIRONMENTS?

**L**ow islands began without any plants or animals living on them. Over time, ocean currents, wind, and birds brought seeds of plants to these new islands. Small plants began to grow. Their roots held sand and rocks, and stopped the waves and currents from easily washing them away.

**T**urtles came to beaches to make their nests. Plants grew and made the soil richer, and this richer soil then helped larger trees to grow on these islands. Birds and bats came flying and made new homes in the new forests. Other land animals, such as lizards and insects, arrived on things that float in the ocean such as logs.

**A**ncient people traveling in canoes discovered these islands. Then more people came and brought animals, built villages, and planted fruits and other plants that they needed.

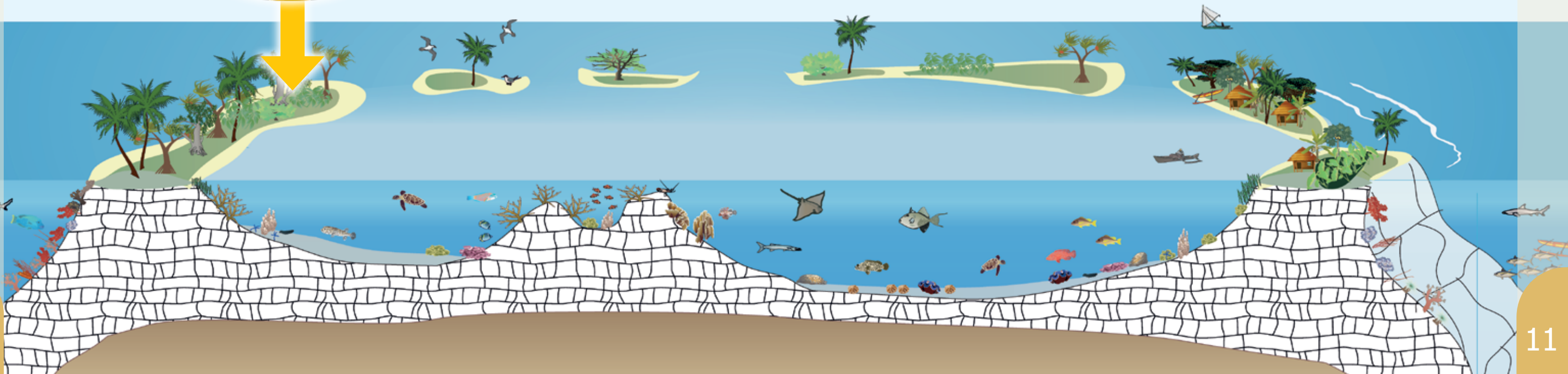
**T**hese low islands that began without plants or animals became home to many different kinds of plants and animals. They live in terrestrial (land) environments, such as forests and gardens. The plants and animals also live in aquatic (water) environments, such as taro pits and the lagoon. Each kind of environment has different conditions that make it a good **habitat** for the kinds of plants and animals that live in that environment.



# ATOLL FOREST

Atoll forests exist on low islands that are not disturbed by human activity. They have trees, bushes, and **herbs** that survive well on low islands. Most of these plants are **native** – they grew on the islands before people came there.

Typical trees in atoll forests are coconut, beach gardenia, fish poison tree, strangler fig, terminalia, wild hibiscus, and lantern tree. Atoll forests are important habitats for many native lizards, birds, and bats.





# AGROFOREST



Many low islands in the Pacific have been inhabited by people for hundreds, or even several thousand years. Ancient people brought breadfruit, taro, pandanus, kinds of coconut, and other plants that they needed.

Over time, contact with people from other islands brought additional useful plants and ways of growing food. These activities have created a kind of man-made forest that is full of fruit trees and other useful plants. Scientists call this type of forest an “agroforest.”

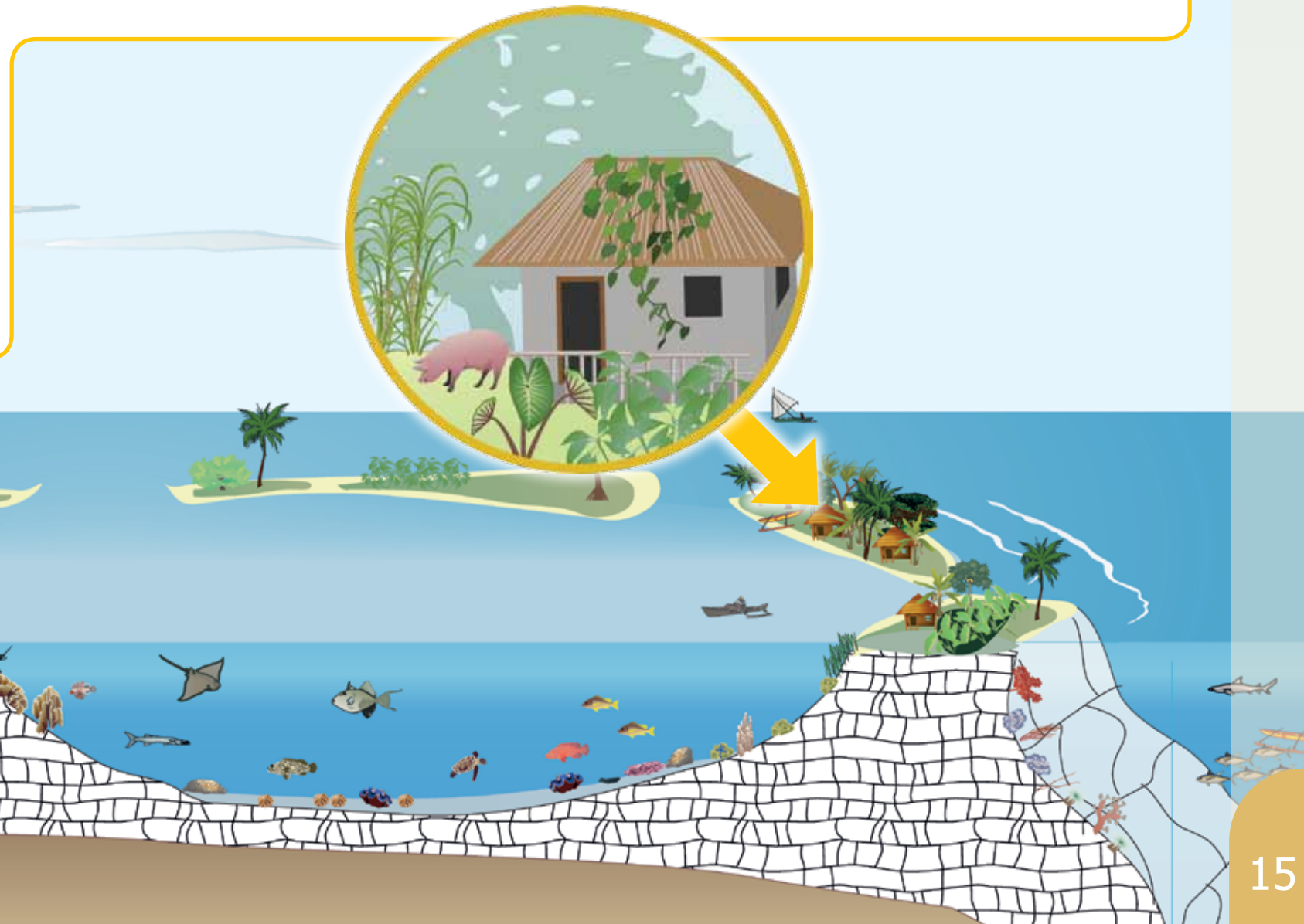


# VILLAGES



In addition to the trees, bushes, and herbs that people planted and carefully managed in agroforests, various native and **non-native** plants grow within villages. People look after some of them. Others are wild plants that are allowed to grow because people use them or simply like the way they look.

Also, there are many weeds that grow wild and are not wanted by people. Weeds are usually non-native plants that grow in disturbed areas such as rubbish piles, roadsides, and messy yards. Some weeds are **invasive**. These invasive weeds grow quickly and spread, and can harm the environment.

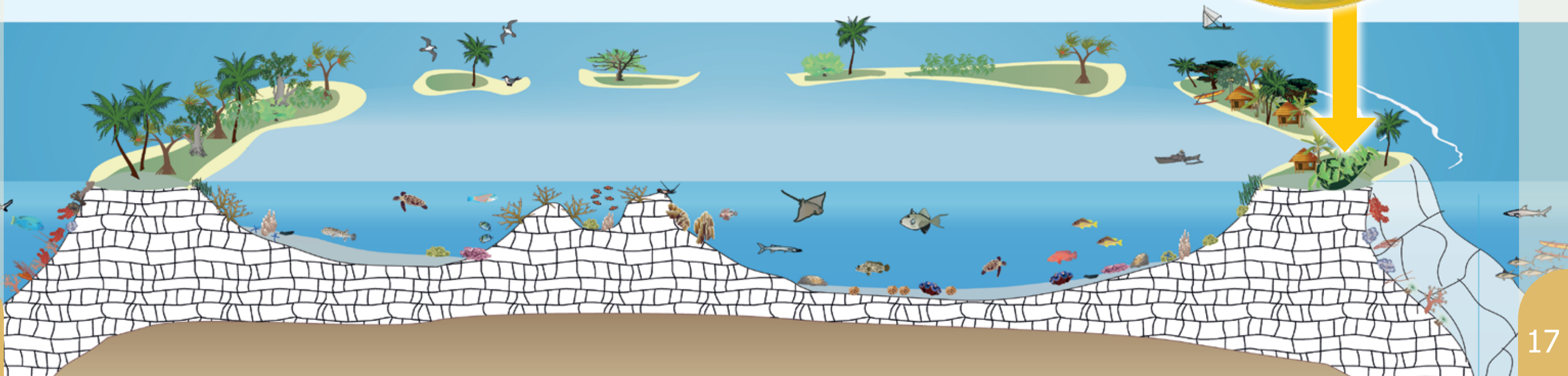
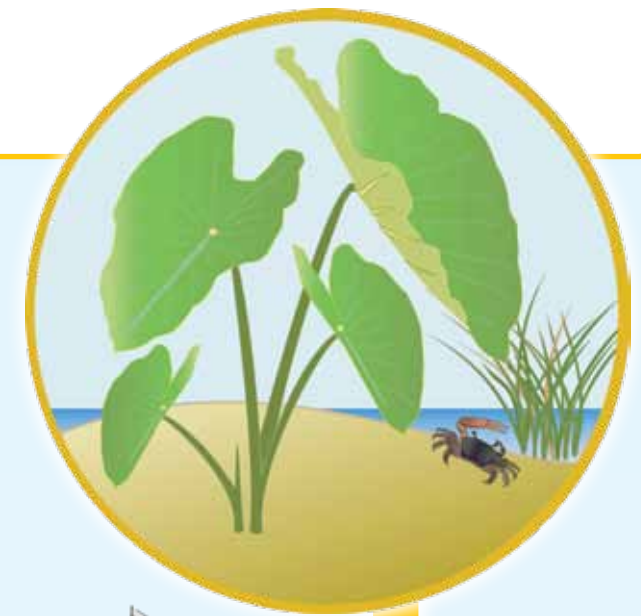


# TARO PATCH



Taro is one of the most important traditional food sources on low islands. Early settlers brought taro with them in their canoes. The kind of taro grown on low islands is typically “giant” or “swamp” taro. It is called “giant” because it has huge heart-shaped leaves, and “swamp” because it can grow only in very wet areas.

The ground a few meters below the land surface has fresh water. People dig deep pits in central parts of their islands to make wetlands where taro can grow well. Kinds of taro that do not need so much water are grown at the edge of these pits.



# LAGOON-FACING SHORE

The side of an island that faces the lagoon gets less wind and waves. These shores are protected from storms and usually have sandy beaches. The sand is made of very small pieces of broken coral and other shells. Very small animals, such as worms and bugs, hide in the sand.

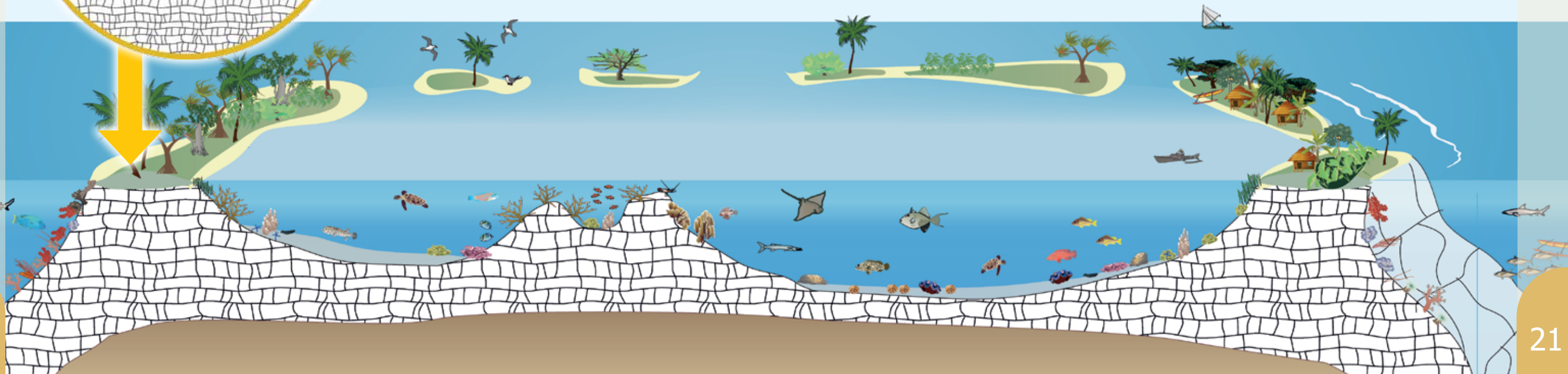
The tiny animals in the sand become food for crabs and birds. Coconut, naupaka, beach gardenia, and other plants that survive near seawater grow near the back of the beach. Unlike most plants, they can live even where there is salt water in the land and air.



# OCEAN-FACING SHORE

The side of an island that faces the open ocean has stronger winds and bigger waves than the lagoon-facing side. As a result, the ocean-facing shore is not sandy, but is made of large pieces of broken coral.

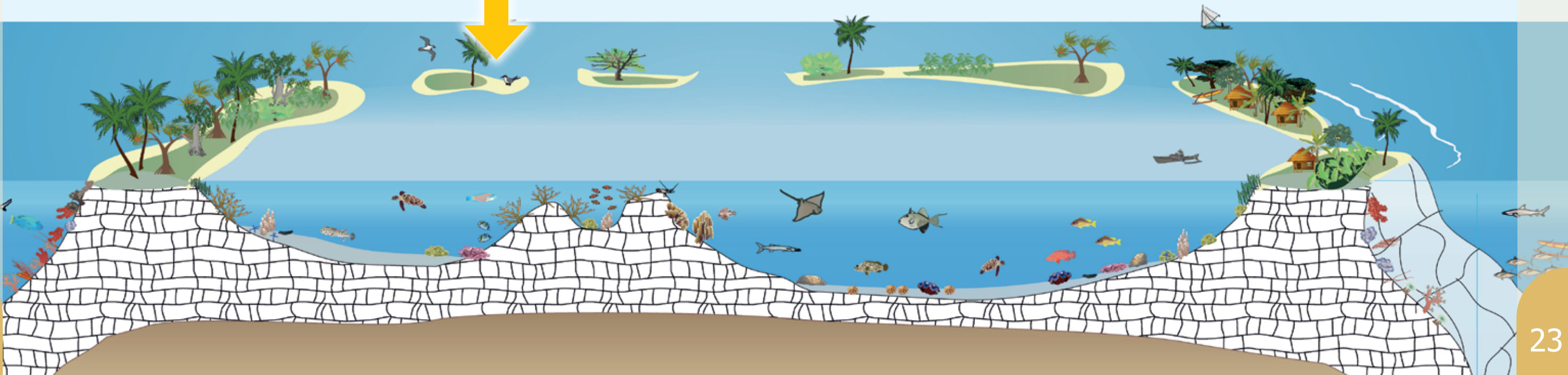
The strong winds and blowing salty water stop most plants from growing there. This is especially true on the windward side of islands. Windward side is the side from which the winds usually blow. On ocean-facing shore that gets less wind, the plants can grow closer to the ocean. On ocean-facing shore that gets more wind, the plants start growing further back from the ocean.



# ISLAND WITHOUT PEOPLE

**M**any islands on atolls are too small and too far away for people to live there. Many animals find peaceful homes on these islands without people. Seabirds lay eggs and raise their young. Sea turtles visit to make their nests. Animals that people hunt and eat, such as coconut crabs, also live on these islands.

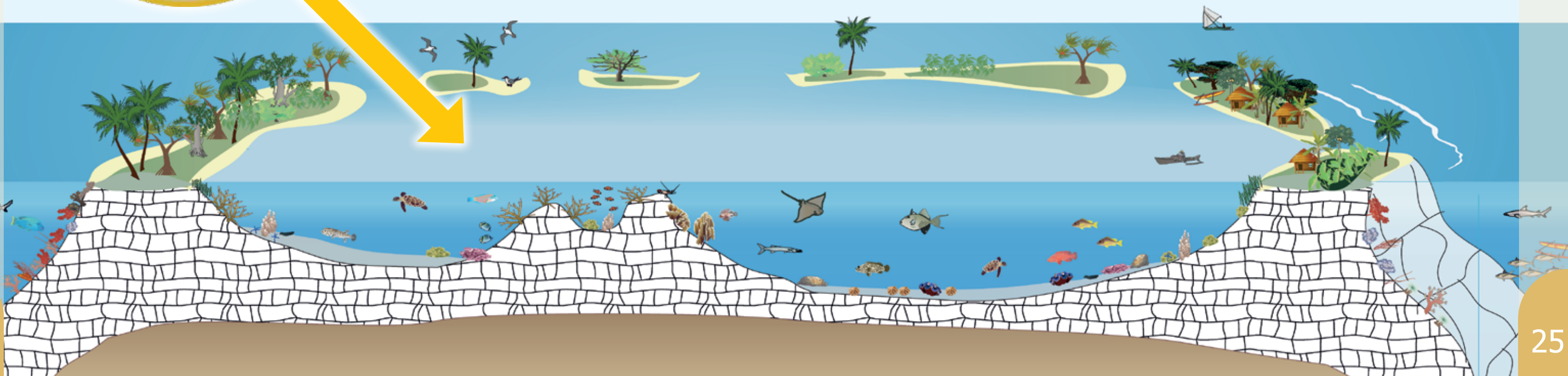
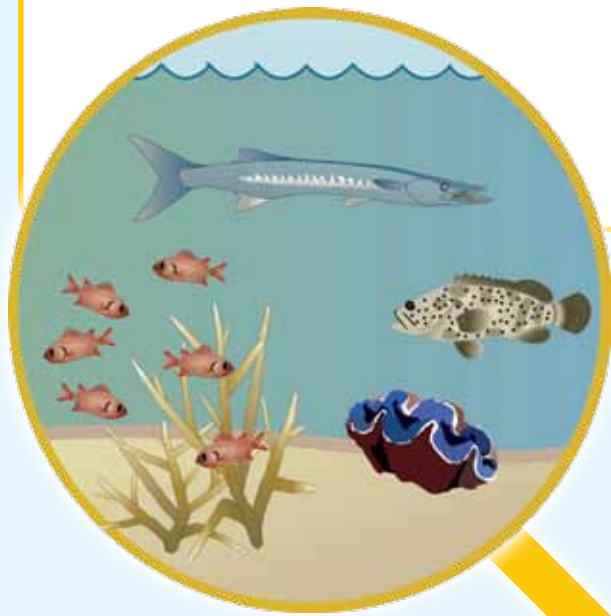
**I**t is important that we do not disturb these animals. These islands are their last safe place to live, and they have nowhere else to go.



# LAGOON

The lagoon is the central part of an atoll. It is ocean that is surrounded by coral reefs. Because reefs shelter the lagoon, it is less deep and has smaller waves than the ocean outside the atoll.

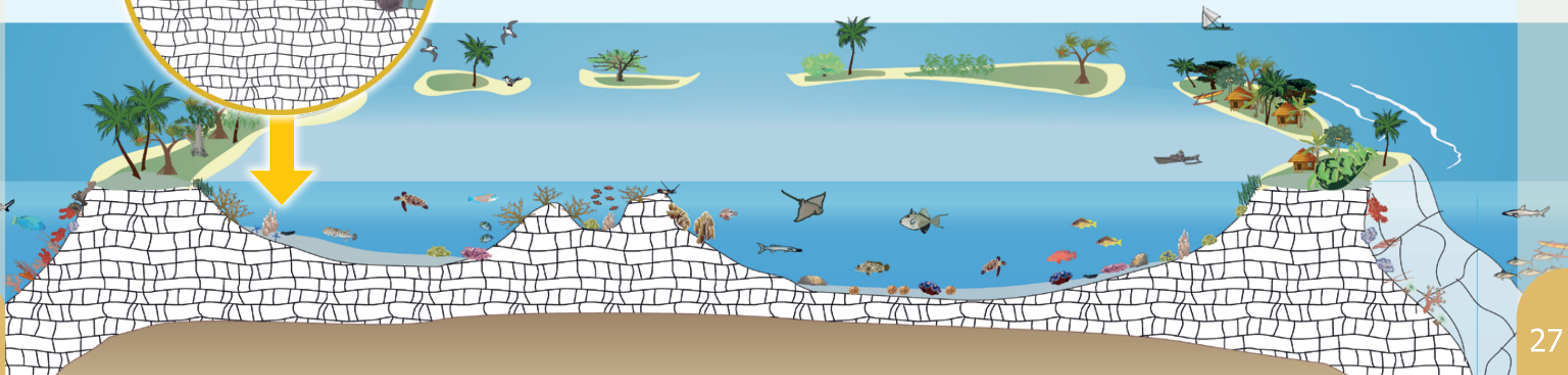
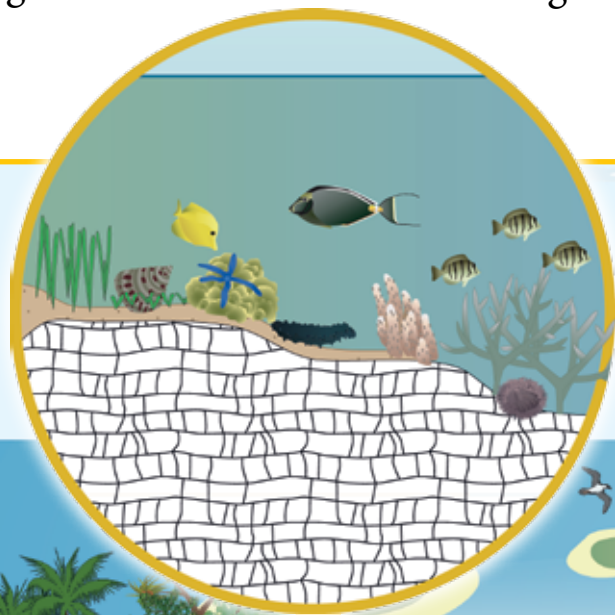
The lagoon bottom is covered by **sediment** (broken pieces of coral and shells of other marine organisms) and can be rocky, sandy, or muddy. Patches of seagrass or coral may grow on the sediment. The lagoon has different habitats that are home to different fish and other sea animals. On many islands, the lagoon is the main source of seafood for people living there.



# LAGOON-FACING REEF

The side of the reef that faces the lagoon is well protected from ocean waves by a barrier of very tough **algae** that resist the breaking waves. In some places, like the one on the photo, the presence of islands provides additional separation between the ocean and the lagoon.

Thus, the lagoon-facing reef is a relatively quiet place where many different corals grow in the shallow and warm water, without much damage by waves. Living among the coral are many **invertebrates** and reef fish. This reef slopes down gently to the bottom of the lagoon.

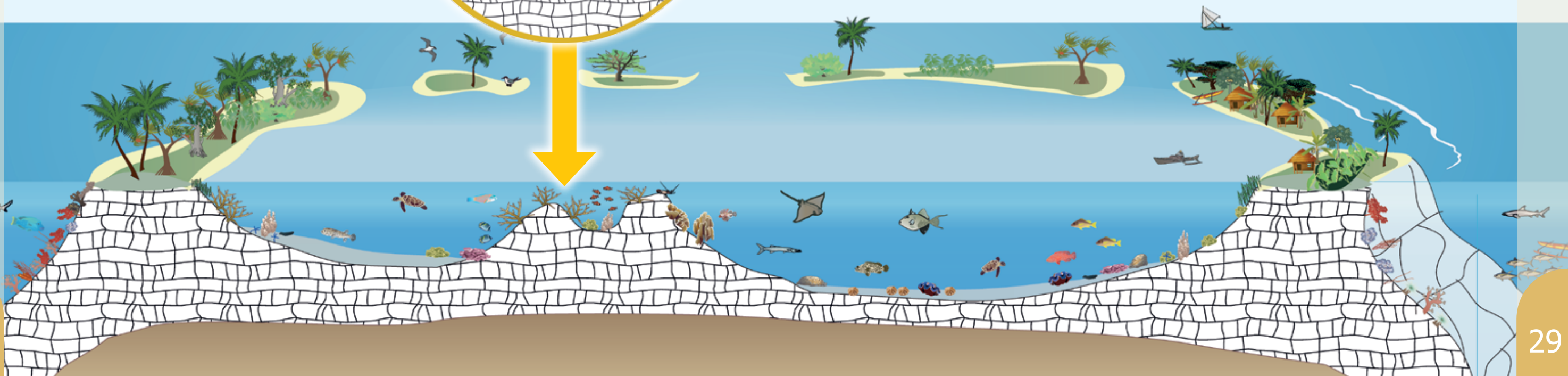




# PATCH REEF

Most of the lagoon bottom is covered by broken pieces of loose sediment. Some parts of the bottom, however, may be made of solid reef. These areas of reef within a lagoon are known as patch reefs. Because living coral needs the sunlight and grows toward the ocean surface, patch reefs are usually the shallowest parts of the lagoon floor. Many patch reefs reach the water surface.

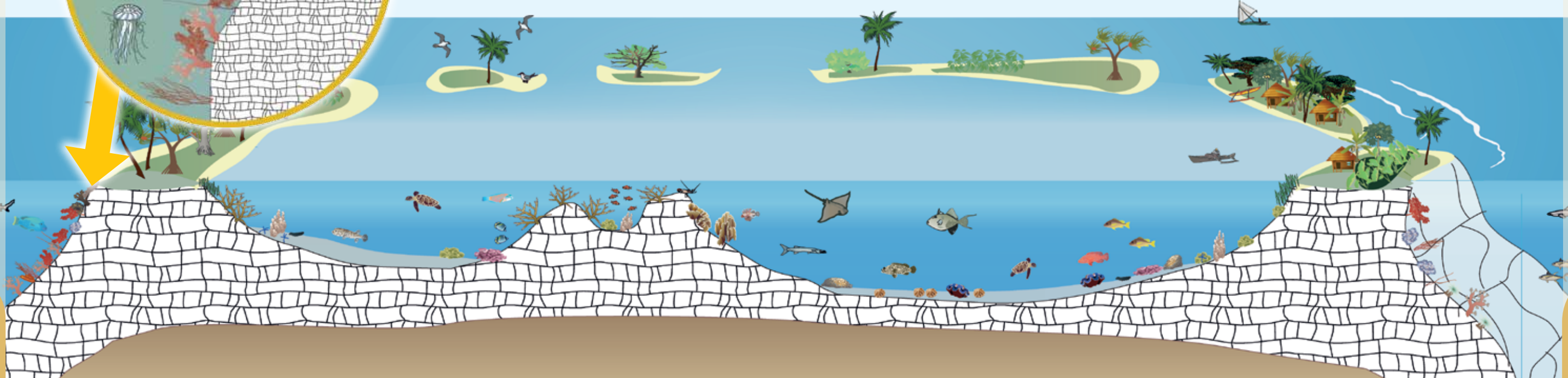
Patch reefs are home to a great variety of sea animals that prefer shallow areas and like to hide in holes provided by the reef. Many of them cannot survive so well on the sandy bottom and deeper water elsewhere in the lagoon.



# OCEAN-FACING REEF

The ocean-facing edge of an atoll is where the reef meets the open ocean. It is like a giant underwater wall that reaches from deep water up to the sea surface. The ocean-facing reef is always washed by currents and waves. Shallow areas have very strong water, and only tough organisms can survive there.

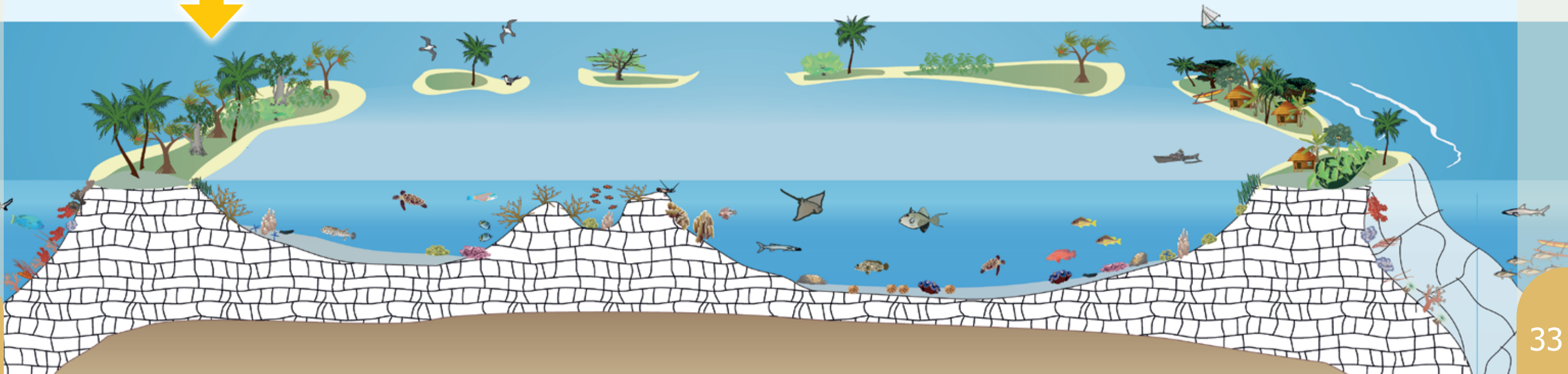
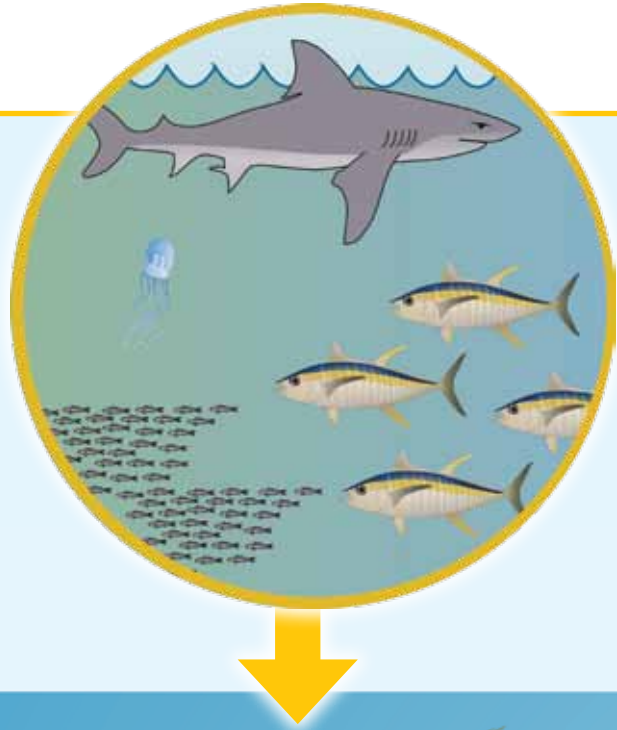
Parts of the reef where the waves break are actually not made of coral because coral are not that strong. Rather, these shallow parts of the reef are made of tough rock-like algae that can handle the waves crashing into them. These rock-like algae protect the lagoon and islands from waves.



# OPEN OCEAN

The open ocean is the sea outside of the lagoon and coastal areas. This is where we find some of the biggest marine life, including large fish such as sharks and tuna, and marine mammals, such as whales and dolphins.

There are also invertebrates such as jellyfish and squid, and huge numbers of tiny organisms known as **plankton**. There are millions of plankton in just one drop of water. Plankton provide food for many marine organisms, and are very important.



# GLOSSARY

**Algae** – plants that live in water and do not have roots. Some algae have skeletons and help build very strong reefs.

**Atoll** – ring-shaped coral reef and low islands that mostly or completely surrounds a lagoon.

**Climate** – the kind of weather that a place usually has in different times of the year.

**Habitat** – a natural home for a plant or animal.

**Herb** – a small plant that is used to give flavor to food or used as a medicine.

**Invasive** – a non-native plant that grows fast and spreads into new areas.

**Invertebrate** – an animal that does not have a backbone such as a clam or a squid.

**Lava** – very hot melted rock that comes out of a volcano.

**Native** – a plant or animal that lived in a place before people got there.

**Non-native** – a plant or animal that people brought to an area on purpose (such as pigs) or by accident (such as rats).

**Organism** – a plant, animal or other kind of living thing.

**Plankton** – very tiny organisms that float in huge numbers in each drop of water.

**Sediment** – broken pieces of coral, shells, and remains of living things that settle to the bottom of the water.



# TEACHING TIPS

## ISLAND SOILS AND GARDENS

Collaborate with a local expert farmer or island plant manager to investigate which seeds grow best in different kinds of soil.

- Collect four different kinds of seeds from local plants and the Agroforest.
- Label each container with the name of its seeds.
- Collect soil from four different locations, including a sandy beach, and label the soil containers.
- Try to grow each kind of seed in each of the different soils and in the sand. Give each the same amount of water and light.

Observe and keep records of plant growth for all seeds and soils. Include the height of the plant and number of leaves. You can also experiment with starting the seeds by keeping them moist on a towel before planting them in the soil. Make illustrations or graphs to share your results with other students.

Now students can do controlled experiments to investigate the effects of changing the amount of water, light, or different materials added to the soil (such as salt or fertilizer). For each experiment, have students predict what they think will happen (such as how the amount of light will affect the seeds germinating or the plants growing). For each experiment, remind students to keep everything the same except for the one variable they are testing.



## TAKING NOTES AND COMMUNICATING ABOUT ISLAND FORMATION

Have students take notes on and communicate about island formation, using key vocabulary from the page, “What Is A Low Island?”. Group students into four language levels (beginning, early intermediate, intermediate and early advanced). Provide sentence frames to each group appropriate to their language level. The sentence frames help students focus on locating key ideas in the book and then communicate ideas in sentences. Create word walls on the topic at hand, and model and practice how to use those words. Below is an example of differentiated support for each language level. These examples help students gather information from the book and then communicate their knowledge about the formation of igneous rocks, which are the basic type of rock in volcanic island formation.

<p><b>Beginning</b> (Support: Glossary and fill-in-the-blanks with simple sentence structure)</p>	<p>High islands in the Pacific usually started as <u>volcanoes</u>. High islands are surrounded by a <u>coral reef</u>. The coral reef can become an <u>atoll</u>.</p>
<p><b>Early Intermediate</b> (Support: Glossary, fill-in-the-blanks with some compound sentences)</p>	<p>After the <u>high island</u> sinks, the coral can keep staying above the <u>water</u>. The coral reef together with the <u>lagoon</u> that it surrounds is called an <u>atoll</u>.</p>
<p><b>Intermediate</b> (Support: sentence frames to create more complex sentences, some prompts with contextual clues, and Glossary]</p>	<p>An atoll is shaped liked the coast of the <u>island that disappeared</u>. The piles of <u>rubble</u> and <u>sand</u> can become <u>small islands</u> that are very different from high islands. Compared to high islands, small islands are <u>narrow and flat/much smaller/do not have hills or mountains</u>.</p>
<p><b>Early Advanced</b> (Support: open ended prompts and word wall)</p>	<p>High islands are formed by... Small islands are formed by...</p>

## COMPARING ENVIRONMENTS ON HIGH ISLANDS AND LOW ISLANDS

- A.** Have students work in groups to identify two interesting environments on the kind of island on which they live (low or high) and two interesting environments on the other kind of island. Lead a whole class discussion about their choices, and then assign two environments (one from a high island and one from a low island) to each group of students. Try to maximize the number of different environments.

Begin a K-W-L chart with students work in their group to record what they know about their assigned low island environment and high island environment. Fill in the column “What I Know.” Elicit questions that they have about these environments and record under the column “What I Want to Know.”

K-W-L chart		
Topic: _____		
What I Know	What I Want to know	What I Learned

- B.** Have students continue working in the same groups to read about and take notes on the two environments. Make a T chart to record information on the environments on both islands from texts.

Use the T chart to compare an environment on a low island with an environment on a high island. Use details from the book to compare plants and animals in the two environments and their sources of water and food.

T chart	
Topic: _____	
High Island Environments	Low Island Environments

Discuss the similarities and differences between the two environments, using compare/contrast signal words such as “both” and “similar” for similarities, and “different than” and “on the other hand” for differences. Use the word “because” to elaborate and add more details.

Have the students record what they have learned from their readings and discussions under “What I have learned.”

- C.** Have each group of students work to create models of their two environments. The purpose is to represent the nonliving parts of each environment as well as the living parts of each environment. They can use drawings, photographs and words in addition to local materials. Each student group should also prepare to describe their two environments to other students.
- D.** Arrange for students to make presentations about their environment models with each other. After all students have presented, have students write and draw about the similarities and differences between the environments on low islands and on high islands.

# PHOTO CREDITS

Ethan Daniels/Shutterstock (cover); Sailorr/Shutterstock (inside cover); Andre Seale (back cover)  
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## OTHER BOOKS IN THIS SERIES

This book is a part of the series, Pacific Islands Climate Education Partnership (PCEP), Place-based resources for Pacific Island schools. The series also includes the following titles published thus far.



*Our High Island Home* is a book about natural island environments that Pacific children and their families will enjoy reading together. Highly visual images make familiar high island land- and seascapes come to life. Children living on high islands will recognize their everyday world and yet be amazed at the hidden treasures found within.



*Our Low Island Home* is a book about natural island environments that Pacific children and their families will enjoy reading together. Highly visual images make familiar low island land- and seascapes come to life. Children living on low islands will recognize their everyday world and yet be amazed at the hidden treasures found within.



*Pacific High Island Environments* is a book for those wanting to learn more about the places, plants, and animals on tropical high islands in the Pacific. The reader learns how high islands are formed and the various environments that create habitats for many species of plants and animals. From agroforests to mangrove swamps and lagoons, the reader is connected to island life and how important these environments are for the communities that live there.



*Mangroves—Living on the Edge in a Changing Climate* offers readers of all ages a fascinating journey through the inner worlds of the mangroves. Intricate adaptations and unexpected habitats emerge from the pages of the swamp, unsettling the reader into realizing the incredible value of this island ecosystem. Mangroves provide many resources for local communities, and help reduce global warming by storing more carbon in the soil and its trees than other comparable ecosystems. This book also explains climate change, and how communities can help protect mangroves from climate change impacts such as rising sea levels.



*Adaptations—Finding a Fit in the Changing World* is a book that children and their families will love. It is full of colorful pictures about how living things are adapted to meet their basic needs in the places they live. Children will be fascinated to learn that some plants have developed chemicals so that animals that share their environment will not eat them. Children will also learn that there are many different types of birds' beaks, all adapted to meet their need for getting food in different places. As children turn these pages, they quickly realize that all living things adapt to get what they need. It is this unique ability to adapt that help all living things survive.





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