Suggested Activities

Duration	3 hours
Recommended for	Secondary
Subject Links	Science, National Education, Geography
Related topics in curriculum/Learning outcomes	• identify a habitat and some of the organisms associated with the habitat (Sci) • show an understanding that habitat together with the organisms living in it forms an ecosystem (Sci) • explain the importance of conserving the environment (Sci) • show awareness and concern for local plants and animals and the impact by people's activity on our environment (NE) • understand the environment of Singapore – Weather, climate and natural vegetation(Geog) • manage the changing environment (Geog)
Equipment/ Materials	Binoculars, Digital Camera , Water bottle The book "Our Fragile Rainforest", published by NParks

Pre-activity

Teacher to share with the class, the book "Our Fragile Rainforest" on the visualizer, about some of the different flora and fauna in our rainforests prior to the Learning Journey.

Use worksheet 1 to discuss about the effects of climate change, flora and fauna in the rainforests that are affected by the climate change, the challenges confronting the rich biodiversity in our rainforests and the role that rainforests play in combating climate change.

Pupils can go home to read more about the organisms found in Bukit Timah Reserve from this link http://www.ecologyasia.com/html-loc/bukit-timah.htm

Activity

1. Bring students to the Central Nature Reserve (Bukit Timah Nature Reserve/ Mac Ritchie Reservoir), planning your routes using the "Our Fragile Rainforest", published by NParks.

2. Distribute Worksheet 2 and encourage them to take photographs of the animals they see in the rainforest and write down notes about them.

3. Students to complete the worksheet by looking out for story boards in the reserve. Information can also be found from the book "Our Fragile Rainforest".

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4. Gather students to debrief the activity, get students to try to identify some of the animals they had seen in the forest using the book "Our Fragile Rainforest".
   (Note: forest animals are rather shy and you may not get to see many of them as they may be camouflaged or in hiding.)

Post-activity

Use worksheet 3 to explain how different animals use a combination of adaptive mechanisms to survive in their environment.

Use worksheet 4 to pen down their pledges in combating climate change and/or saving the rainforests. Display pledges on class notice boards.

Pupils can also take up following research project in groups and present to the class or school (during school assembly).

Suggest and discuss a feasible programme for the re-introduction or population restoration of one of the native endangered mammal/feathered species in our rainforests. You may choose one of the following animals:

- Lesser Mouse Deer
  http://www.wildsingapore.per.sg/discovery/factsheet/mousedeer.htm
- Banded Leaf Monkey
  http://www.wildsingapore.per.sg/discovery/factsheet/bandleafmonkey.htm
- Anteater or Pangolin
  http://infopedia.nl.sg/articles/SIP_1455_2009-02-23.html
- Oriental Pied Hornbill
  http://www.wildsingapore.com/wildfacts/vertebrates/birds/albirostris.htm
- Smooth Otter
  http://www.naturia.per.sg/buloh/verts/smooth_otter.htm
- Slow Loris
  http://www.wildsingapore.per.sg/discovery/factsheet/slowloris.htm

NParks has been enhancing biodiversity and protecting ecosystems to preserve life on Earth. You may want to direct the pupils to visit the biodiversity page from the NParks website (www.nparks.gov.sg) for more information on the biodiversity of Singapore and to find out more on different conservation initiatives in Singapore. You can do can do your part in Conservation!

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Climate Change affecting our Fragile Rainforest

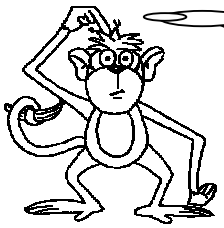
Name: _____ ( ) Class: _____ Date: _____

1. What are some of the effects of climate change?
   (a) _____
   (b) _____
   (c) _____
   (d) _____
   (e) _____

2. Research on one native animal or plant in Singapore rainforests that was affected by climate change and has become endangered. Suggest one way of conservation.
   Hint: You may want to visit the biodiversity page from the NParks website (www.nparks.gov.sg) for more information on the biodiversity of Singapore and to find out more on different conservation initiatives in Singapore. You can do can do your part in Conservation!

   Common name of organism: _____
   National Status: _____
   Habitat: _____
   How it could have been endangered due to climate change: _____
   _____
   _____
   Conservation measures: _____
   _____
   _____

3.



When the environment of my habitat changes, will I be able to survive?

Match some of the factors affecting organisms' survival rate to the correct descriptions.

Factors			Descriptions
Resilience	•	•	How mobile is the species able to venture beyond the traditional boundaries and move to new habitats.
Habitat	•	•	How well can a species tolerate drastic changes in environmental conditions?
Reproduction	•	•	Is there alternative water source if streams in the rainforests were reduced to a trickle?
Diet	•	•	Is breeding behaviour triggered by any particular environmental cue? How many offspring are produced per mating? How regular is the species known to breed?
Water	•	•	Is there sufficient shade or shelter to hide from the heat?
Mobility	•	•	What is the relative availability of food? Does the organism have a generalist or specialist diet?

Roles of Rainforests – 3 'C's

4. Conservation of the rainforests in Singapore is important for many reasons. The rainforests act as a carbon sink, cools down the environment and also acts as a water catchment area.

➢ Cool

Explain how the trees help to keep the temperature cool in the rainforests.

_____

_____

➢ Carbon Sink

How does the rainforests act as a carbon sink?

_____

_____

➢ Catchment

Explain the role of rainforests in water catchment.

_____

_____

_____

Field Trip Record

Name: _____ ( ) Class: _____

Learning Journey to _____

Date: _____ Time: _____

Organism spotted	What group of living things does it belong to? (Plant/Animal/Fungi/Bacteria)	What community does it belong to?	Descriptions/information/drawings

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Organism spotted	What group of living things does it belong to? (Plant/Animal/Fungi/Bacteria)	What community does it belong to?	Descriptions/information/drawings

Reflections: _____

_____

_____

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Tricks for survival in the Rainforest!

Name: _____ ( ) Class: _____ Date: _____

Organisms in a habitat are well adapted to their environment in order to survive. Study the rainforest animals below and write down how the adaptation mechanisms described are structural or behavioural and how these adaptations helped in their survival.

(A) Malayan Colugo's Adaptations

	Mechanism	Type of adaptation (Structural/Behavioural?)	How this helps the species in its survival
1	It has a very large flexible membrane that acts like a parachute.		
2	It has fur which blends with the colour of the tree bark.		
3	It stays motionless on the tree in the day.		
4	It is active at night.		

(B) Pangolin's Adaptations

Mechanism		Type of adaptation (Structural/Behavioural?)	How this helps the species in its survival
1	It has strong claws.		
2	It has long sticky tongue		
3	It has scales.		
4	It can roll up into a ball when threatened.		
5	It is active at night.		

(C) Assassin Bug's adaptations

	Mechanism	Type of adaptation (Structural/ Behavioural?)	How this helps the species in its survival
1	It possesses a flexible, segmented proboscis that deliver potent toxin into a victim's body.		
2	At the juvenile stage, certain nymphs cover themselves with debris (above).		

(D) Moth's adaptations

	Mechanism	Type of adaptation (Structural/ Behavioural?)	How this helps the species in its survival
1	It looks brown like dried leaves.		
2	It is active at night.		

My Pledge

5 ways to protect our rainforests...

COOLER FUTURE

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Secondary

(Our Fragile Rainforest)

Answer Key

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Answer Key

Question 1
Effects of Climate Change

* Warmer days and nights.
*Parts of the world may **starve** in the future because the changing climatic conditions can have devastating effects on **agriculture**.
* **Hurricanes**, **wildfires** and other weather-affected natural disasters will become stronger and more frequent.
* Rising ocean levels will drown **coastal cities** and millions, probably **billions of people may become homeless and jobless**.
* These people have to be relocated somewhere and given financial help. Millions of **environmental refugees** will migrate to countries with better conditions for life. This will not be free of conflicts and possibly wars.
* Many animal and plant species will lose their habitats and may go extinct.

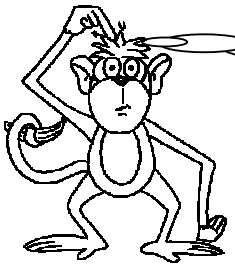
Question 2
Pupils could search for many other endangered animals threatened by climate change from the **Singapore Red Data Book 2008**

Suggested answers (extracted from the Singapore Red Data Book):

Common name: **Malayan Horned Frog**
National Status: Endangered
Habitat and Ecology: Inhabits mature forest and swamp-forest where it is usually found on the forest floor, and along small shallow streams.
Distribution: In Singapore, confined to the Central Nature Reserves largely in two locations.
Threats: Habitat degradation, particularly from the possible drying up of the Bukit Timah forest.
Conservation measures: Continued protection of known habitats.

Common name : **Pregnant mother moss**
National Status: Critically Endangered (CR)
Habitat and Ecology: Growing on wet rocks and pebbles in shaded sites along streams and forest trails.
Distribution: In Singapore, found only in one locality in Bukit Timah Nature Reserve and one other site in Bukit Batok..
Threats: Degradation and drying of suitable habitats.
Conservation measures: Protection for the known localities of this moss in Singapore needs to be continued, and other examples of suitable habitat should be sought.

Question 3



When the environment of my habitat changes, will I be able to

Match some of the factors affecting organisms' survival rate to the correct descriptions.

Factors	Descriptions
Resilience	How mobile is the species able to venture beyond the traditional boundaries and move to new habitats.
Habitat	How well can a species tolerate drastic changes in environmental conditions?
Reproduction	Is there alternative water source if streams in rainforests were reduced to a trickle?
Diet	Is breeding behaviour triggered by any particular environmental cue? How many offspring are produced per mating? How regular is the species known to breed?
Water	Is there sufficient shade or shelter to hide from the heat?
Mobility	What is the relative availability of food? Does the organism have a generalist or specialist diet?

Answer Key

Roles of Rainforests – 3 'C's

Conservation of the rainforests in Singapore is important for many reasons. One of them is the supporting roles they play in combating climate change.

➢ Cool

Explain how the trees help to keep the temperature cool in the rainforests.

Ans: A combination of tall trees, dense vegetation and multiple layers in the rainforest helps to block out heat and light from the Sun.

➢ Carbon Sink

How does the rainforests act as a carbon sink?

Ans: Rainforest captures large quantities of carbon dioxide, a greenhouse gas from the environment during photosynthesis. Cumulatively, our rainforests act as significant carbon sinks, storing excess carbon quantities and only releasing them progressively with the decomposition process.

➢ Catchment

Explain the role of rainforests in water catchment.

Ans: The forests that surround our central reservoirs serve as a water catchment. Numerous streams meander through these forests, purifying the water and eventually entering the reservoir. Without the rainforests, these fragile streams cannot be sustained and will be choked with silt and run dry.

Tricks for survival in the Rainforest!

(A) Malayan Colugo's Adaptations

	Mechanism	Type of adaptation (Structural/ Behavioural?)	How this helps the species in its survival
1	It has a very large flexible membrane that acts like a parachute.	Structural	The membrane is able to act like a parachute to help it glide a long distance so that it can escape predators easily.
2	It has fur which blends with the colour of the tree bark.	Structural	The colour of fur helps it to camouflage with the surrounding so it is not easily detected by the predators.
3	It stays motionless on the tree in the day.	Behavioural	Staying motionless on the tree helps it to escape detection by the predators.
4	It is active at night.	Behavioural	There are fewer predators at night, so this behaviour increases its chance of survival.

(B) Pangolin's Adaptations

Mechanism		Type of adaptation (Structural/ Behavioural?)	How this helps the species in its survival
1	It has strong claws.	Structural	The strong claws help to break into ants' and termites' nests so that they can get their food easily.
2	It has long sticky tongue	Structural	The long sticky tongue helps it catch insects for food.
3	It has scales.	Structural	The scales protect the pangolin from ant bites.
4	It can roll up into a ball when threatened.	Behavioural	This behaviour protects them from the attacks by the predator.
5	It is active at night.	Behavioural	There are fewer predators at night, so this behaviour increases its chance of survival.

(C) Assassin Bug's adaptations

	Mechanism	Type of adaptation (Structural/ Behavioural?)	How this helps the species in its survival
1	It possesses a flexible, segmented proboscis that deliver potent toxin into a victim's body.	Structural	The toxin immobilise the victim so that it can devour/eat its prey easily.
2	At the juvenile stage, certain nymphs cover themselves with debris (above).	Behavioural	To camouflage itself and aid in sneaking up on unsuspecting prey.

(D) Moth's adaptations

	Mechanism	Type of adaptation (Structural/ Behavioural?)	How this helps the species in its survival
1	It looks brown like dried leaves.	Structural	The colour helps it to camouflage in the forest so that predators will not see it.
2	It is active at night.	Behavioural	There are fewer predators at night, so this behaviour increases its chance of survival.

Answer Key

5 ways to combat climate change..... (Suggested ways)

- Reduce your carbon footprint.
- Plant a tree. Trees help to slow climate change because they absorb carbon dioxide during photosynthesis. Trees also provide shade, which helps keep streets and houses cooler in the summertime and reduces the need for air conditioning. (Join GreenWave 2012)
- Spread the word. Give a presentation to your family, school, or community group that explains how their actions can cause or reduce climate change.
- Bring reusable bags when you go shopping.
- Don't leave the refrigerator door open! This lets cold air escape, making the refrigerator work harder and use more energy. Decide what you want before you open the door.
- A household dryer uses an average of 750 kWh per year, which means a lot of energy is used to dry your clothes! So don't run the dryer for just a few things; dry a full load.
- Only wash clothes when you have a full load of laundry, using cold water when possible
- Pack a waste-free lunch to school. Waste requires energy for disposal, so packing your lunch with reusable or recyclable items can help save energy and reduce greenhouse gas emissions.
- Consider buying locally grown food. The further your food travels, the more greenhouse gas emissions are produced in transporting the food from the farm to your plate.
- Turn off lights when you don't need them—when light bulbs burn out replace them with energy-efficient bulbs;
- Do not waste water ;
- Recycle;
- Encourage your parents to drive fuel-efficient cars

5 ways to save the rainforests..... (Suggested ways)

- Teach others about the importance of the environment and how they can help save rainforests.
- Restore damaged ecosystems by planting trees on land where forests have been cut down.
- Encourage people to live in a way that doesn't hurt the environment
- Establish parks to protect rainforests and wildlife
- Support companies that operate in ways that minimize damage to the environment
- Use recycled paper.