Episode 3:
How does climate change affect us?

What does climate change look like? How will Singapore be impacted? Join Jo, the Singapore freshwater crab, on a journey to discover what happens to oceans, forests, wildlife, and people when the fragile balance of life is disturbed with too much greenhouse gas emissions in the atmosphere. Find out why Jo, as a critically endangered and endemic crab, is concerned about the sixth mass extinction.

What is in this guide:

- Suggested discussion for video
- Suggested role-play activity on how carbon flows within the environment
- How to conduct the activity sheet with your students

Additional resources:

- Appendix 1: Role-play cards
- Appendix 2: Climate change gets personal in Singapore
- Further readings

Suggested discussion for video

Recall

- What do forests provide for animals, plants, and people?
- What is one harmful effect when forests are cut down?
- Name two diseases that have been transmitted from animals to humans.
- Who suffers when oceans become more acidic?

Explain

- Why are forests important in the fight against climate change?
- What does the growing human population have to do with deforestation?
- Why will there be more deadly zoonotic diseases when humans and animals live closer to each other?
- Why will the extinction of species upset the balance of life on Earth? How are species dependent on one another?
- Why are oceans becoming more acidic?

Infer

- Why are forests described as “magical”?
- In your own words, explain why coral reefs are referred to as “Forests of the ocean.”
- How will protecting natural ecosystems like forests and oceans benefit people in the long run?

Suggested role-play activity on how carbon flows within the environment

How to play:

- This game aims to get students to visualise the flow of carbon within the environment, between living and non-living things.
- Divide students into 8 groups. Randomly assign each group one role-play card: Atmosphere, water, aquatic animals, aquatic plants, land animals, land plants, fossil fuels, humans. [See Appendix 1]
- Each group will be provided with 4 ping pong balls that represent carbon. [Note: ping pong balls can be replaced with other objects to represent carbon. You can also change the number of balls provided to students, depending on how many are participating.]
- Students work in their respective groups to make decisions on which group to pass their carbon to. Since carbon exists in all categories represented on each role-play card, each group must hold at least one ping pong ball at any one time.
- This role-playing game will be conducted twice. For the first round, the “humans” group will sit out and in the second round, they will participate.
- Get students to observe the difference.
    - What are humans’ carbon impacts on the environment?
    - How do activities like burning fossil fuels, deforestation, transport, and food production result in more carbon in our atmosphere and accelerated global warming?
    - Explain that students have not created more carbon but simply moved carbon from one place to another, resulting in today's climate events like higher temperatures, rising sea levels, etc.

How to use the activity sheet with your students

Learning outcome:
To reflect on how my actions today will have an impact on the future of Singapore.

Guiding questions:

- Discuss this article on "Temperatures in Singapore could hit 40°C as early as 2045:
    - The article mentioned that Singapore's hottest months in the 1970s are now the same temperature as our coolest months.
    - What are the effects of a warming Singapore? [**See Appendix 2**]
    - How will this affect Singapore's natural environments like forests and coasts?
- Get students to reflect on the video.
    - What daily habits/behaviour can you change today to have a livable planet in the future?
    - Think of something you like best – it could be a place you enjoy going to, food you enjoy eating, an activity you enjoy doing or even your favourite animal/plant. How could it be affected by climate change?
- What advice do you think you would give to your future self?

Extend:
SG Climate Rally, a youth-led organisation, is concerned about Singapore's future too. They want to encourage Singaporeans to think about what Singapore should look like in 2050. Read about what other Singaporeans have posted at https://padlet.com/sgclimaterally/takeback2050 and contribute your own too.

WRITE A LETTER TO MY FUTURE SELF

Imagine it is the year 2050. Take a minute to imagine what Singapore would look like if we continued to live the way we do now.

Now, think of what you hope Singapore will look like in the future. Use the template on the next page to write your letter, or simply go to https://www.futureme.org/ and type your letter. You can set a date to decide when to receive the letter in the future by typing in your email address.

Want to go one step further?
SG Climate Rally, a youth-led organisation, wants to encourage Singaporeans to envision what Singapore should look like in 2050. Read what other Singaporeans have posted at https://padlet.com/sgclimaterally/takeback2050 and contribute your own too.

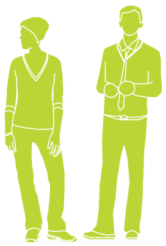
Consider:

- How much warmer do you think Singapore will be?
- Will Singapore still have natural environments like forests and coasts? Why or why not?
- What daily habits/behaviour would result in such a future for Singapore?
- Think of something you like best – it can be a place you enjoy going, a food you enjoy eating, an activity you enjoy doing or even your favourite animal/plant. How can it be affected by climate change?
- What advice do you think you would give to your future self?

Suggested ideas:
- Living in harmony with wildlife by...
- Reducing my carbon footprint by...
- Minimising my food wastage by...
- Spreading this message to my family and friends by...
- Refusing single-use disposables by...

Challenge: The video mentioned that the world is undergoing the sixth mass extinction. How will the extinction of certain plants and animals affect you?

Sample Answer Key



Dear future me

Dear Future _____, (*Your name*)

Hi! Today, the date is 20 June 2070 and I am 50 years old and I am a teacher (*state your job/what you are doing*). Thankfully, the weather is now 35 °C (*temperature*) and not what was predicted by scientists to be over 40°C.

This is because of what humans like me have been doing for the past few years. I have been:

1. Reducing my carbon footprint by walking or taking public transport instead of a car.

2. Minimising my food wastage by only ordering what I can finish .

(*state 2 environmentally friendly habits/behaviours that you want to do*)

As a result, my favourite activity of swimming (*state place/ food/ activity/ animal*) is still around because I have been careful to not pollute the ocean and participated in beach clean-up activities.

(*state what positive actions you took*)

To my future me, here is my piece of advice to you:

People need nature to thrive. Every breath we take, every drop we drink, every bite we eat, it all comes from nature. So cherish nature and just as how we love to be taken care of, let's take care of what is around us too.

Love,

_____ (*your name*)

Appendix 1: Role play cards

ATMOSPHERE

You are the breathing skin of Earth that enables life. But the more carbon there is in you, the warmer Earth gets as carbon in the form of carbon dioxide is a heat-trapping gas (also known as a greenhouse gas).

Who you can pass carbon to:

1) **Water** – carbon dioxide is absorbed by water bodies to form carbonic acid.
2) **Land plants** – plants absorb and store carbon dioxide through photosynthesis.
3) **Aquatic plants** – plants absorb and store carbon dioxide through photosynthesis.

WATER

You are the origin of all life on Earth. But you also function as a good carbon sink by removing carbon from the atmosphere when carbon dissolves in you.

Who you can pass carbon to:

1) **Aquatic plants** – plants absorb and store carbon dioxide through photosynthesis.

AQUATIC ANIMALS

You are a wide variety of animal life found in essential water bodies like rivers, lakes, and oceans. As living things, you are part of an important food chain and ecosystem.

Who you can pass carbon to:

1) **Water** – carbon dioxide is absorbed by water bodies to form carbonic acid.
2) **Aquatic plants** – plants absorb and store carbon dioxide through photosynthesis.
3) **Fossil Fuels** – when you die, the carbon in you gets buried and is subjected to intense heat and pressure over millions of years, leading to the formation of fossil fuels.

Appendix 1: Role play cards

AQUATIC PLANTS

You are the seagrass meadows, kelp forests, algae and other plant life that thrive in freshwaters or seawaters. You are food producers, but you also remove carbon dioxide from the atmosphere through photosynthesis and store it in you and the ecosystem around you.

Who you can pass carbon to:

1) **Aquatic animals** – carbon in you is passed on to aquatic animals through the food chain.
2) **Water** – carbon dioxide is given out through respiration.
3) **Atmosphere** – carbon dioxide is given out through respiration.
4) **Fossil Fuels** – when you die, the carbon in you gets buried and is subjected to intense heat and pressure over millions of years, leading to the formation of fossil fuels.

LAND PLANTS

You are the flowers, trees, shrubs, bushes, and grasses found on land. You are food producers, but you also remove carbon from the atmosphere through photosynthesis and store it in you and the ecosystem around you.

Who you can pass carbon to:

1) **Land Animals** – carbon in you is passed on to land animals through the food chain.
2) **Atmosphere** – carbon dioxide is given out through respiration.
3) **Fossil Fuels** – when you die, the carbon in you gets buried and is subjected to intense heat and pressure over millions of years, leading to the formation of fossil fuels.

Appendix 1: Role play cards

LAND ANIMALS

You are all the mammals, birds, reptiles, amphibians, and insects found on land. You are consumers and you ensure healthy forests through pollination and seed dispersal.

Who you can pass carbon to:

1) **Atmosphere** – you give out carbon dioxide through respiration.
2) **Land plants** – plants absorb and store carbon dioxide through photosynthesis.
3) **Fossil Fuels** – when you die, the carbon in you gets buried and is subjected to intense heat and pressure over millions of years, leading to the formation of fossil fuels.

FOSSIL FUELS

You are historical, formed from dead plant and animal matter through natural processes like decompositions and depositions over millions of years. As such, you are a non-renewable energy resource.

Who you can pass carbon to:

1) **Atmosphere** – you give out carbon dioxide when humans burn you for energy used to generate electricity, power industries, and transportation like vehicles.

HUMANS

You are an intelligent species. In the last century alone, you have managed to greatly alter the atmosphere and natural environment.

Who do you think you can pass carbon to? Consider the types of activities you engage in.

Appendix 2: Climate change gets personal in Singapore

Did you know that although our tiny island-nation of Singapore is known to contribute about 0.11% of global carbon emissions, individually, our carbon footprint is among the highest in the world? Suppose we are not careful about how we use resources and continue this path of overconsumption. In that case, these are some of the effects we can expect in Singapore - some of which we are already experiencing.

1. Urban heat island effect

Temperatures are higher in a city as heat is absorbed in the day by concrete buildings and infrastructure like roads and released only at night. This explains why in rural Lim Chu Kang, temperatures at night can be as low as 24.8°C while in city areas like Orchard, temperatures at night can be around 5°C higher. Air-conditioning might keep you cool but actually worsens this effect. This leads to a vicious cycle where people will use more air-conditioning, exacerbating the problem of the urban heat island effect.

2. Sea level rise

Singapore is a low-lying island where only 1/3 of Singapore is 5m above sea level. With temperatures rising, ice at the Poles melts faster, leading to sea level rise globally. However, Singapore will get more than 30% of its share of sea level rise as more water will be drawn to the equator.

3. Hotter and wetter weather

2019 was the hottest year on record in Singapore. While this may cause discomfort to people, it would also lead to an increase in diseases like dengue fever which is transmitted through the Aedes mosquito and thrives in hotter and more humid weather. Besides the sweltering heat, Singapore could also experience heavier rainfall. On 2 January 2021, Singapore recorded the highest amount of rainfall in the past 39 years.

4. Threatened food supplies

Singapore imports over 90% of its food supplies and when natural disasters are made worse by climate change strikes in countries that Singapore imports its food from, we might face a food shortage or have to pay more for the same food items we enjoy now.

5. Biodiversity loss and conflict

With the rapid expansion of infrastructure and urbanisation, Singapore is left with fewer and fewer natural habitats where wildlife can call home. Coupled with the unpredictable impacts of climate change and pressures of living near urban areas, biodiversity such as the critically endangered Singapore freshwater crab (*Johora singaporensis*) will find it hard and harder to adapt and survive. With less space for wildlife, people would inevitably find themselves encountering wildlife like wild boar (*Sus scrofa*) and long-tailed macaques (*Macaca fascicularis*) more frequently—sometimes leading to human-wildlife conflicts.

Further readings:

1. Why Singapore is heating up twice as fast as the rest of the world. (2020, December 21). CNA. https://www.channelnewsasia.com/news/cnainsider/singapore-hot-weather-urban-heat-effect-temperature-humidity-11115384
2. Cooling Singapore. (2017). Cooling Singapore. https://www.coolingsingapore.sg/
3. Sea Level Rise Projection Map - Singapore. (2020, October 9). Earth.Org - Past | Present | Future. https://earth.org/data_visualization/sea-level-rise-by-the-end-of-the-century-singapore/
4. Climate change and social inequality. (2017). Department of Economics and Social Affairs https://www.un.org/esa/desa/papers/2017/wp152_2017.pdf
5. Climate refugees. (2021). Lee Kwan Yew School of Public Policy. https://lkyspp.nus.edu.sg/gia/article/climate-refugees-the-expected-climate-change-migration
6. Singapore's Emissions Profile. (2021). National Climate Change Secretariat. https://www.nccs.gov.sg/singapores-climate-action/singapore-emissions-profile/