WELCOME TO THE ECO LEADERS GUIDE!

Over the next few pages, you'll find all the activity guides, aids, tests/quizzes, worksheets, and templates for **'Chapter 1: Exploring the Issues of the Greater Mekong Subregion'** from the Eco Leaders Guide. Use the hyperlinks below to quickly access the specific resource you need.

CHAPTER 1: Exploring the Thematic Issues of the Greater Mekong Subregion

To view the full chapter or the complete toolkit, click here to return to the main Eco Leaders Guide website.

USAID
FROM THE AMERICAN PEOPLE

WWF

Eco Leaders Guide

WWF's Environmental Education and Youth Advocacy Toolkit for the Mekong Region

Disclaimer:
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1.1.1

WATERSHED PUZZLE

Age Group: 15 years old and above.

Time Required: 1 1⁄2 - 2 hours

Location: Area with shelter and good writing space/floor

Author: Wet Project

Photo Credit: Traidhos Barge Program

Materials: Flipchart or poster paper, lottery sign, drawing pens, color pencils, crayons, food coloring, etc. (for "pollution") and a bowl of water.

ACTIVITY DESCRIPTION

Participants will demonstrate how to form a river system. Starting from the headwaters, each person is asked to explain their development and how it will affect the water quality of the river (i.e. which types of pollution does their development add to the river and why). Participants will add pollution (food coloring, paper, soil, coffee, etc.) to a container of clean water, which represents what they have contributed to the river's pollution. Likewise, if they developed their land into a nature reserve they can add some fresh water to help dilute the concentration of the pollution. Eventually the last person will end up with a bucket full of very disgusting looking water, signifying the waste that has accumulated along the whole watershed.

LEARNING OUTCOMES

Participants will...

- Recognize that everyone contributes to and is responsible for a river or lake's water quality.
- Identify ways to reduce pollution.
- Develop conservation practices in their community or school to reduce waste.

SAFETY CHECK

- Don't visit sites by yourself, especially in the evening or in high risks areas.
- Don't get into the water if you do not know how deep it is.
- Don't touch the water without any protection, especially if you do not know how contaminated the water is.
- If possible, bring life-jackets for everyone on your team.

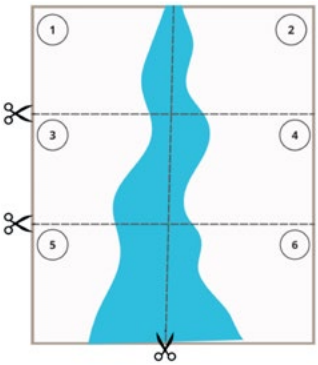
BACKGROUND INFORMATION

The quality of water in a river is, to a large extent, a reflection of land uses and natural factors found in its watershed. If soil near a river naturally erodes, chances are the river has sediment and turbidity problems. If the land has stable vegetative cover, erosion is kept in check. When humans settle and develop land, water quality is affected. Breaking sod, cutting forests, building cities, mining and other land have an impact on water quality.

Everyone bears responsibility for the health of a watershed and the water systems (river, lakes, wetlands, etc.) within a drainage basin. Individual action, both negative and positive, add up. Understanding a river or lake's water quality involves investigating the condition of the contributing watershed. If the watershed is polluted, the river will likely be polluted.

Sources for more information: *Project Wet Curriculum & Activity Guide. The Watercourse and Western Regional Environmental Education Council*

SET UP



Using a blue marker on large poster paper, draw an outline of the River (that you contextualize your learning around) from the water head down to the gulf or a lake. Divide the river in half down the middle and crosswise into sections. Each section should include a bit of river and blank space to allow room for learners' drawings. The number of sections should correspond with the number of groups of learners working together. Number the sections on one side of the river in sequential order, placing numbers in upper left/right corners and repeat for the other side. Cut out the quadrants.

HOW TO RUN THE ACTIVITY

Engage (5 minutes): This can be a role play in which the instructor is a funny game show character. The character will present each person with a "Congratulations, you have won US$600,000" (convert to your local currency).

Explore (10 minutes): What river are we on? What is a watershed? Can you name the rivers that make up this delta/river system? Where do these rivers originate? What are some of the prominent land uses that you have noticed while cruising along the river? Do you think any of these land uses negatively affect the watershed? What do you think the attitude of downstream residents might be about the water received from their upstream neighbors?

Explain (5 minutes): Remind the participants that they have just inherited a river front and US$600,000. Have them list the ways they could use the land and the money. Possible land uses include farming, mining, logging, residences, industries, temples, parks, etc.

Activity (30 minutes)

Step 1:

- At this point the participants will start their drawings.
- It is important that they are creative but are reminded that they have US$600,000 to spend (don't forget to convert the amount to your local currency). Describe what that amount could buy in real life.
- Once they have completed their drawings, have them turn their paper over. On the back side they should write the reasons they chose to develop the land the way they did, and what they used water for**.**

Step 2:

- Ask the participants to put their papers back in chronological order. Explain that each piece is actually part of a puzzle. Starting with number one, have participants assemble their pieces. Tape the watershed together again.

Step 3:

- Produce a container of clean water.
- As the discussion takes place, pass the container down the watershed, adding pollutants as it reaches the sea. Have each person describe how they developed their land and how they used water. Give them a representation of their contributions to the river with an item from the pollution box.
- After each group has described their development and added pollution, pass it on to the next group. The group that developed the gulf area / lake will eventually have a container with a lot of polluted water.

POSSIBLE POLLUTION CAUSES:

- Landslides/erosion/dirt = soil and leaves
- Food waste = old food
- Household waste = plastic, paper, string
- Garden waste = green tea leaves
- Petrol and oil from engines = cooking oil
- Soil = Ovaltine
- Rubbish/trash = white crumpled paper
- Runoff from farms = food coloring.
- Clean water = cup of clean water
- Factory waste = add hot water
- Sewage = anything that resembles sewage!
- Fertiliser and chemical waste = vinegar (no color but strong smell)

Evaluate (10 minutes): Ask these question to the group and explore their answers together

- What was the condition of the water in the north of the watershed at the start of the game?
- What is it like now at the gulf/lake?
- How did that happen?
- How did the groups in the middle and end of the watershed feel?
- How did their property plans affect the river pollution levels?
- Can a downstream user be affected by an upstream user? Could upstream users alter the water quality of those downstream?

Elaborate

Option 1 (20 minutes): Ask the participants what they could do to prevent water sources being polluted. This may include:

- Take shorter showers so less grey water flows to rivers
- If you are playing in a waterfall, do not use soap or shampoo
- If your family car leaks oil on the road, get it fixed
- Refuse single use plastics
- Carry your own bag, straw, lunch container
- Plant trees/leave green margins next to rivers to absorb hot runoff
- Support organic products so artificial fertilizer use is minimized

Option 2 (20 minutes): Show the participants the water quality map of the river they have drawn. Explain that the map on the left is what they want the river to look like and the one on the far right is what the river looked like in year XXXX and the one to the left is how it looks now.

Ask them if that confirms what they have just learned in the activity: that the start of the waterway is always cleaner than the lower section. If time permits, show them a satellite image of your country. Then ask the participants to find that river on the map. Explain to them what the colors mean and what colors used to be predominant along the river. How has this affected the quality of the river? Where do they think their fish comes from, and how about their trees? (This might be a non sequitur but it could lead to a conversation about minimizing waste.)

Further Activities

It will be helpful to review concepts such as watershed and drainage basin, as well as point and non-point source pollution. This can tie in nicely with the water quality tests.

Ask the participants to write a one paragraph description of ways to reduce the amount of pollution he/she contributed. The participants can research the regulations governing waterfront property in their communities. If they feel their waterways are poorly treated, have them write letters to government officials supporting stricter laws and more enforcement.

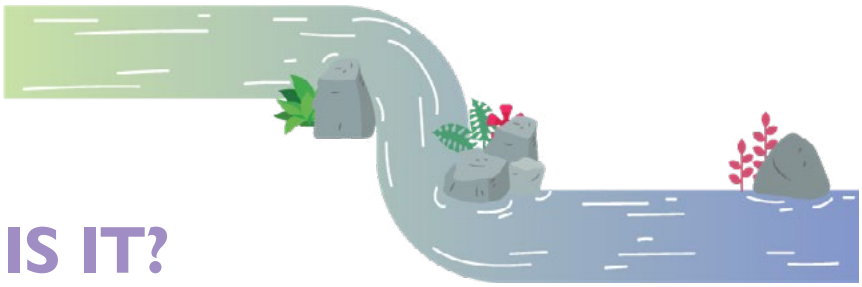
Variations

You could also start the activity with a river full of trash. See if participants can figure out what to do with their land that will reduce the waste flowing through the river. Depending on what they build, have them take a certain amount of trash/ dirt from the river. See if there is a way to eradicate all the waste flowing into the delta - a good way to get focused on clean up instead of pollution.

1.1.2

FRESHWATER ECOSYSTEM OBSERVATION

HOW HEALTHY IS IT?



Age Group: 15 years old and above

Time Required: 2-3 hours for the observation trip then 1-2 hours for research and a summary of your findings

Group Size: This activity should be done in pairs or small group(s)

Location: Area with shelter and good writing space/floor

Materials:

1. 1. Field observations worksheet with pens or pencils
2. 2. Gloves, plastic bottle or glass jar for water collection and Litmus paper (if available)
3. 3. Fishnet or aquarium net with a tray (if available)

Activity Objectives/Participants will...

- Get a deeper understanding of the functions of the local waterway and its ecosystems;
- Recognize the importance of freshwater ecosystem habitat and that a diverse river or stream habitat is crucial for maintaining a healthy waterway;
- Utilize critical thinking to conduct a scientific investigation of the ecosystem's health.
- Be able to assess the overall environmental health of the community's water ecosystem based on the observations and findings.

YOUR ASSIGNMENT

Your assignment is to take a couple of hours for a walk along the river, stream, or canal near your home or community. Something that is not well understood by most people is that rivers, streams, and even man-made canals are not simply drainage channels for water to flow down. They are also the homes of freshwater animals and different plants. A diverse river or stream habitat is, therefore, the key foundation to a healthy waterway. Using your sight, hearing, touch and your brain power, make a thorough scientific investigation of this water ecosystem to determine what the overall environmental health is.

Once you have completed your investigation, your task will be to write a short and informative report about the environmental health of your community's water ecosystem. Ask your friends or a mentor to review and help edit it before you send it to your local environmental organization or use it for your blog post, information board, or other materials.

SAFETY CHECK

- Don't go by yourself, especially in the evening or to a potentially high risk area.
- Don't get into the water if you don't know how deep it is.
- Don't touch the water without any protection, especially if you don't know how contaminated the water is.
- If possible, bring enough life-jackets for everyone in your team.
- Check the weather when you are planning to go on a field investigation!

FIELD OBSERVATIONS

Date: _____

Time: _____

Location: _____

Instructions: Walk along the river, stream, or canal near your home or community and collect as much of the following information as you can with the time and materials you have available. Remember to consider safety as your first priority.

1. **First of all, describe the type of the water ecosystem (river, stream, canal lake, etc):**

   - ☐ Stream or canal
   - ☐ River
   - ☐ Wetland or lake

2. **What is the extent of alteration?**

   - ☐ 100% natural
   - ☐ Slightly modified
   - ☐ Extremely modified

3. **Draw a simple sketch of the water ecosystem and its two banks (sides)** and indicate through labels what you estimate to be the depth of the water and width of the channel. Also show in the sketch what the vegetation looks like along the banks and in the water.

WATER ECOSYSTEM SKETCH

4. **Collect water from the river, stream, canal, or wetland using the plastic bottle or glass jar.** Observe the color and smell of the water, and mark in the appropriate box to record your observations.

Smell: What does the water smell like?

- ☐ No smell
- ☐ Slight smell
- ☐ Strong smell
- ☐ Very strong smell

Water Color: What color is the water that you can see in the container?

- ☐ No color - looks good, but could still be contaminated
- ☐ Turbid brown - there is soil in the water from erosion of land and/or banks
- ☐ Clear like tea - color of decomposed vegetable matter. Could be natural
- ☐ Green - color of suspended algae; maybe too much fertilizer or organic matter
- ☐ Yellow - color of another type of algae; also indicates pollution from fertilizer or organic matter.
- ☐ Grey/black - heavily polluted with sewage
- ☐ Other colors (describe): _____

5. **pH level of the water:** _____

Here is how to measure the pH level:

- Take a strip of litmus paper and dip it into the water sample you want to test.
- Remove the paper and observe the color change.
- Compare the color of the litmus paper to the color chart provided with the litmus paper kit to determine the pH level of the water.

Note: The optimal pH range for a healthy freshwater ecosystem is considered to be between 6.5 - 8.5

6. **The Water Current: How fast does the water at the surface of the channel travel?**

- ☐ Very fast
- ☐ Fast
- ☐ Moderate speed
- ☐ Slow
- ☐ Standing water

7. **Life around the water ecosystem: What things live in the water or in the area of the banks?**

Take some time to look around the area of the banks and in the water to see what plants, animals or insects there are. Look for big things as well as little things. Look at the surface of the water. If the water is clear, try to observe life in the water. If you can, filter the water with a fishnet, and look under logs and rocks. Try not to disturb or harm living things. Put them back after observation. **Note:** Take photos of anything you find during observation that you do not recognize.

Record your observations in the space provided below:

Mammals	**Birds**	**Amphibians and Reptiles** (frogs, salamanders, snakes, & lizards)

Flying insects

Crawling or walking insects

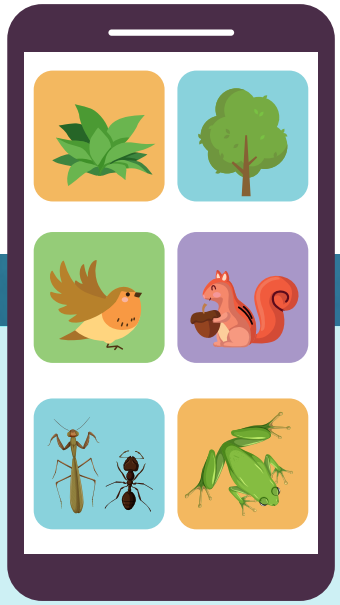
Water insects

Fishes

Invertebrates

Plants and algae

PLANTS AND ANIMALS IDENTIFICATION MOBILE APPLICATIONS



PLANTS AND ANIMALS

iNaturalist: A joint initiative by the California Academy of Sciences and the National Geographic Society, iNaturalist lets you upload photos of plants and animals for identification by a community of experts and enthusiasts. It includes many species from Asia.

Seek by iNaturalist: Seek is a free app designed for beginners. It provides immediate identification using the same database as iNaturalist and rewards users for their discoveries. It includes many species from Asia.

Google Lens: Although not a dedicated plant identification app, Google Lens can identify a wide variety of plants. Simply take a photo with Google Lens, and it will provide information about the plant.

PLANTS

PlantSnap: PlantSnap allows you to identify flowers, trees, succulents, mushrooms, and more. It has a large database and covers many Asian plants. You can take a photo of the plant, and the app will provide identification. You can use it to identify up to five plants a day for free—beyond that, a paid plan is required.

PlantNet: PlantNet is a free app that allows users to identify plants from photos. It has a large database and is supported by a community of users who help verify plant identifications.

Flora Incognita: This app allows for the identification of plants through photographs. It's known for its accuracy and includes many species found in Asia.

BIRDS, INSECTS, REPTILES AND AMPHIBIANS

Merlin Bird ID by Cornell Lab: Merlin Bird ID is an excellent app for bird enthusiasts. It helps identify birds based on photos and bird songs. It includes a wide range of birds found in Asia and provides detailed information about each species.

Picture Insect: Bug Identifier: This app is great for identifying insects and spiders. It has a large database and can identify many species found in Asia.

HerpMapper: Reptiles and amphibians Identifier: Users can upload sightings, and the community helps with their identification. It includes many species found in Asia.

Each of these apps has its own strengths and features, so you might want to try a few to see which one.

8. **Garbage & Waste:** Garbage and other forms of human waste can pollute rivers and streams as well as actually harm aquatic animals and the people who use the water from that source. They are also very ugly. Note the different types of garbage that you find in the water and along the banks for at least ten meters on each side. Mark ☑ in the appropriate box.

- ☐ Food scraps - they pollute the water if fish cannot eat them
- ☐ Paper - it pollutes the water
- ☐ Plastic - it is harmful to aquatic animals if eaten or if they get trapped inside
- ☐ Glass - it does not cause pollution since it is made from sand, but broken glass is dangerous and can cut people
- ☐ Cans/ metal scraps - sharp edges are dangerous to animals and people.
- ☐ Chemical containers / Oil cans / Spray cans / Batteries – Chemical residue left inside may contaminate and pollute the water.
- ☐ Animal droppings and human feces - they pollute the water and spread disease
- ☐ Dead animals - they pollute the water and can spread diseases
- ☐ Other garbage: _____

9. **Your Conclusions:** In the space below write a short summary of the conclusions of your observation and investigation concerning the environmental health of the river, stream or canal. Make sure to explain your findings with proper reasons and facts/observations.

Adapted from: Kanjanavanit, Oy and Moonchinda, Narumol, Handbook for Stream Detectives, Green World Foundation, 1999.

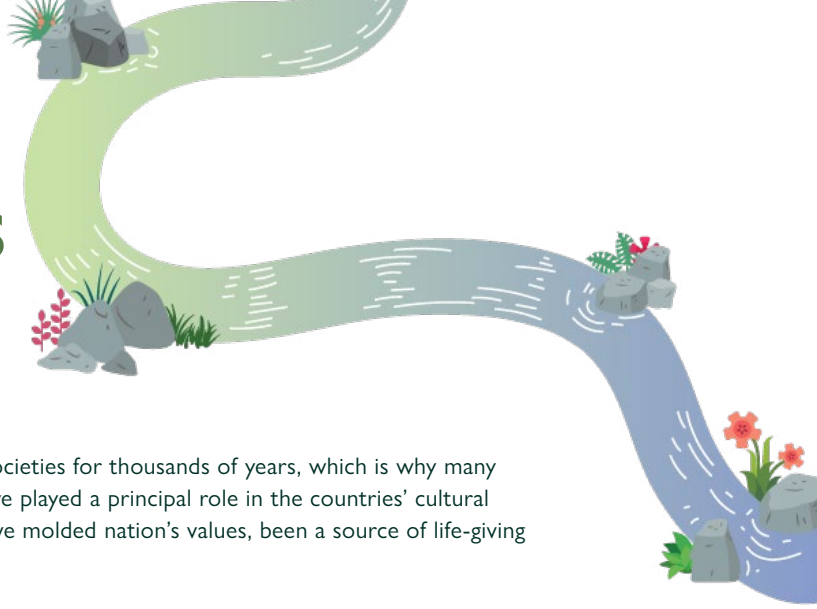
FRESHWATER ECOSYSTEM HEALTH REPORT

Title of Report: _____

My Thoughts and Feelings After Completing This Assignment:

1.1.3

INVESTIGATING OUR COMMUNITY'S LINK WITH RIVERS OR WETLANDS



Rivers have played an important and life-sustaining role in human societies for thousands of years, which is why many of the world's great cities sit on the bank of a great river. Rivers have played a principal role in the countries' cultural traditions and beliefs, political history, and in economics. Rivers have molded nation's values, been a source of life-giving food, served as our highways and linked our communities.

Age Group: 15 years old and above

Time Required: 2-3 hours for the observation trip then 1-2 hours for analysis

Group Size: This activity should be done in pairs or small group(s)

Materials:

1. A notebook with pens or pencils
2. Phone for voice recording and photographs

Activity Objectives/Participants will...

- Develop questioning and interpersonal communication skills.
- Gain an understanding of the role the water ecosystem plays in daily lives.
- Gain perspectives from community members about what they feel are the current issues regarding the river or stream in your community.

YOUR ASSIGNMENT

Your assignment is to go into the community and find out what people think of their connection with the closest river, stream, canal, and/or wetland, what role the water ecosystem plays in their daily lives, and what they feel are the current issues surrounding it.

Discuss with your team to determine the number of interviewees that you feel represent the community and fit within the time that you have.

When your investigation is completed, you should write a short news article or blog post about the results of your investigation.

REMEMBER

- When planning to meet with community members, choosing the best time in a day for each person is crucial for maximizing engagement. The optimal time can vary based on several factors including people's work schedules, family considerations, cultural and religious practices, and other specific needs.
- Dividing roles among your team members will make your interview more effective. These roles can include interviewer, note taker, photographer, etc.
- Do not forget to ask for permission before you take photographs or video.
- Check the weather when you are planning to go on a field work!

PREPARING YOUR INTERVIEW QUESTIONS

- Start with general and simple questions before moving on to more complex ones
- Ask "open questions" rather than "closed questions" that have only one answer like yes or no. Open questions encourage people to talk with more details.
- Questions that begin with 'why', 'how', or 'when' are good open questions because they encourage people to think hard about the reasons why things happen.
- Other good questions are those which ask about local people's knowledge and ideas about the river or stream, including current situations taking place.
- By asking questions that encourage people to review changes over time will give you a clearer understanding of the current situation. Example: "What differences have you noticed in the water quality of the local river over the past ten years, particularly in terms of clarity, odor, and the presence of wildlife?"

Need more tips? *Visit* ***Chapter 2 Developing an Advocacy Position*** *to see some tips on how to conduct interviews*

List some of your prepared interview questions below:

Test the questions you listed on your friends or mentor before using them in real interviews!

List of Community People that You Interviewed:

1. Name: _____ **Age:** _____ **Occupation:** _____

Address: _____

Telephone no.: _____ **Date of interview:** _____

Summary of main answers:

_____

_____

_____

_____

_____

_____

2. Name: _____ **Age:** _____ **Occupation:** _____

Address: _____

Telephone no.: _____ **Date of interview:** _____

Summary of main answers:

_____

_____

_____

_____

_____

_____

3. Name: _____ **Age:** _____ **Occupation:** _____

Address: _____

Telephone no.: _____ **Date of interview:** _____

Summary of main answers:

_____

_____

_____

_____

_____

_____

List of Community People that You Interviewed:

4. Name: _____ **Age:** _____ **Occupation:** _____

Address: _____

Telephone no.: _____ **Date of interview:** _____

Summary of main answers:

_____

_____

_____

_____

_____

_____

5. Name: _____ **Age:** _____ **Occupation:** _____

Address: _____

Telephone no.: _____ **Date of interview:** _____

Summary of main answers:

_____

_____

_____

_____

_____

_____

6. Name: _____ **Age:** _____ **Occupation:** _____

Address: _____

Telephone no.: _____ **Date of interview:** _____

Summary of main answers:

_____

_____

_____

_____

_____

_____

After conducting the interviews, use the table below or recreate the spreadsheet to collect all your information in one place.

INTERVIEW SUMMARY- Investigating our Community's Link with Rivers or Wetland

Instructions

- Use the table below, or recreate it using Microsoft Excel or another spreadsheet software, to collect all the information you received from the interviews you have conducted.
- Add the key questions your team has agreed should be asked in every interview into the table.
- Feel free to adjust the table to fit your interview plans, e.g. adding more columns for more questions

Interviewee Information			**Summary of the response to key questions asked during the interview**				**Notes**
Interviewee Name	Age	Occupation	Q1	Q2	Q3	Q4	Any observations, topic to do more research, etc.

COMMUNITY RIVER LINKS REPORT

You should invest time and effort to develop an article. Researching and presenting additional information that provides more context to the interviews and broader issue can ensure your work is comprehensive and impactful. By thoroughly understanding the issues, you can present well-informed and persuasive arguments, highlight diverse perspectives, and propose effective solutions. This dedication to accuracy and depth not only strengthens the credibility of your advocacy but also helps educate and engage a broader audience, ultimately driving meaningful change in your community.

Title of Report: _____

My Thoughts and Feelings After Completing This Assignment:

1.1.4

FRESHWATER ECOSYSTEMS HEALTH MAPPING

Developing a visual representation of climate change processes and linkages map can deepen your comprehension of the causes and effects of climate change and highlight the intricate connections among its various elements. This improved understanding of climate change is crucial for making informed decisions when addressing this global challenge.

Age Group: 15 years old and above

Group Size: This activity can be done individually or in small group up to 6 people maximum. If there are more people, please consider to make more groups.

Time Required: 45-60 minutes

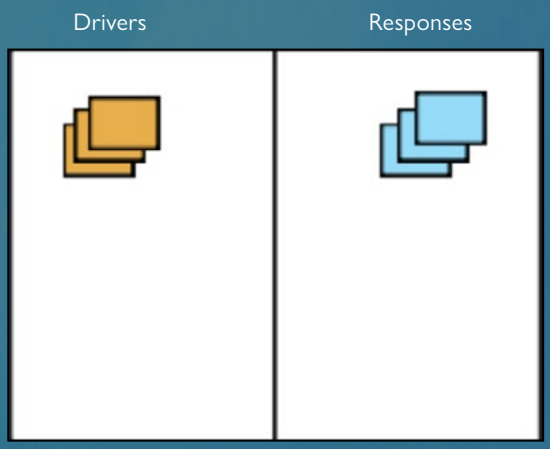
Materials:

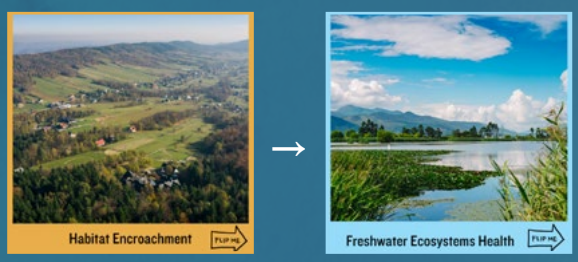
1. **Print out the provided visual elements on A4-size paper, double-sided, and proceed to cut them into individual pieces. Sort them out by color (border color).**
    - The card set contains 2 different colors of cards. Yellow represents the drivers and pressures of the freshwater ecosystem health and blue represents the impacts and responses of the freshwater ecosystem health
    - Each card should feature a picture with a corresponding title on the front side, while the back side should contain a text explanation corresponding to that specific title.
2. **Prepare a big flipchart paper and markers. Fold the flipchart to divide the paper space into 2 sections. If only small-sized flipchart available, you may consider put 2 flipcharts together.**

ACTIVITY INSTRUCTIONS

1. Place flipchart paper on a smooth surface / table.
2. Place the stack of cards on each quadrant of the paper according to color designated (see picture on the right).
3. First, Participants are encouraged to work on the left side of the paper (Drivers and Pressures of the Freshwater Ecosystems Health). Once done, the participants can work on the other cards on the right side of the flipchart paper (Impacts and Responses)
4. Start by putting the blue card, titled **"Freshwater Ecosystem Health"**, in the middle of the flipchart and identify the cause-and-effect relationships of this card with the other cards in yellow colors.
5. Draw an arrow between the 2 interconnected elements to illustrate its directional cause and effect relationship. For example, **Habitat Encroachment → Freshwater Ecosystem Health**

Note: More information provided on the back of each card. If you get stuck in identifying the cause and effect relationship among these cards, flip the card to read the information provided.





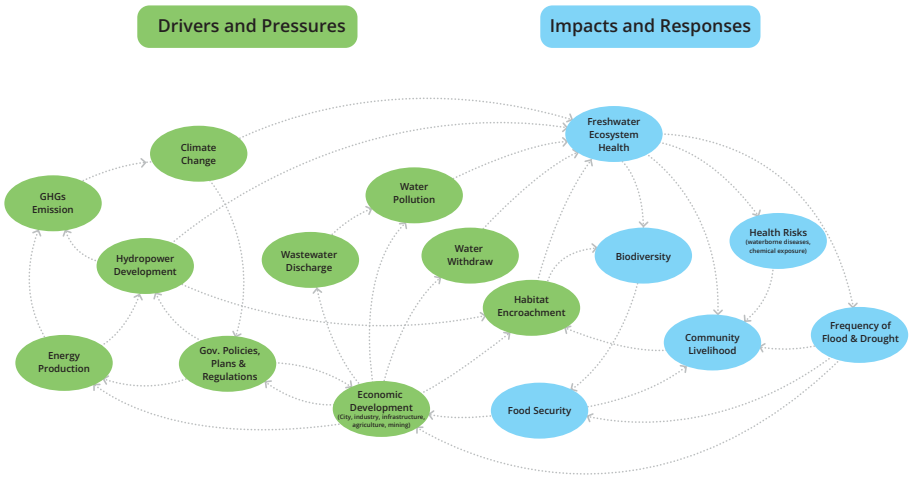
6. Continue to identify the cause-effect linkages between different elements and draw directional arrows to indicates their causal relationships. If you think some elements are missing from this set of cards or, if you would like to add more details, please write down the additional elements on the blank cards provided and include them in your system map.

7. When you are satisfied with the map of the Driver and Pressures of the Freshwater Ecosystem Health (left side of the paper), go ahead and work on the **"Impacts and Responses side"** (right side of the paper), with the card set in blue color.

Note: There are some **blank cards** provided in this card deck. The purpose of having the blank cards are to allow you to expand your view and make connections between climate change and your topic of interest. During the activity, you can add new cards at anytime. It is also okay if you or your group do not use some of the existing cards, if you think these cards are not fit into the conceptual picture.

The system diagram provided on the next page (see picture below) is intended to be used as a guide. It is totally fine if your final map does not look exactly the same with this one. What matters is the conversation/discussion you have with the group.

Master Answer Key



Do not worry if your map does not look exactly like the answer key. What is the most important is the learning and the understanding of the interconnections between different elements in this system map.

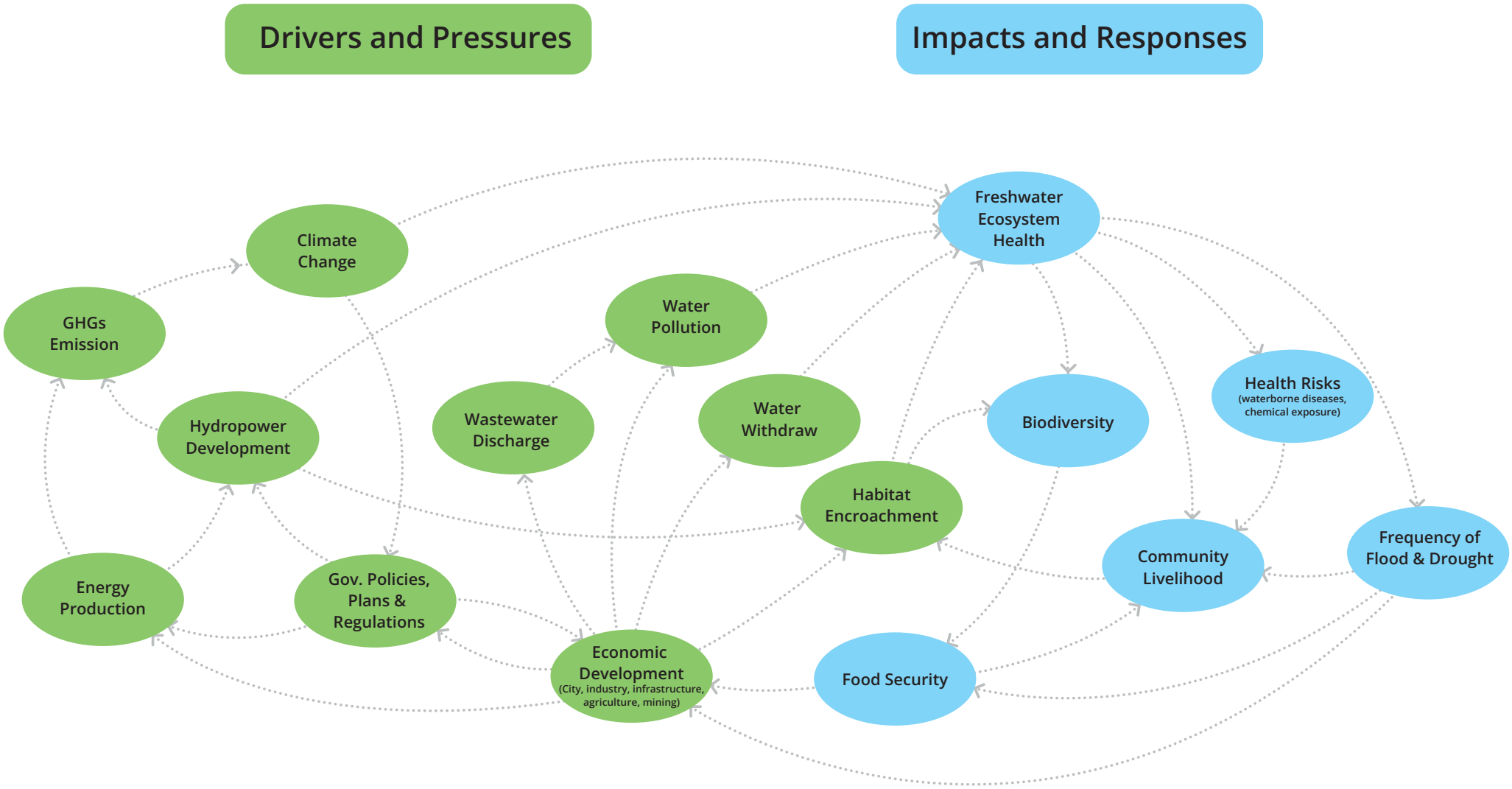
FRESHWATER ECOSYSTEM HEALTH DIAGRAMMING ANALYSIS AND DEBRIEF QUESTIONS

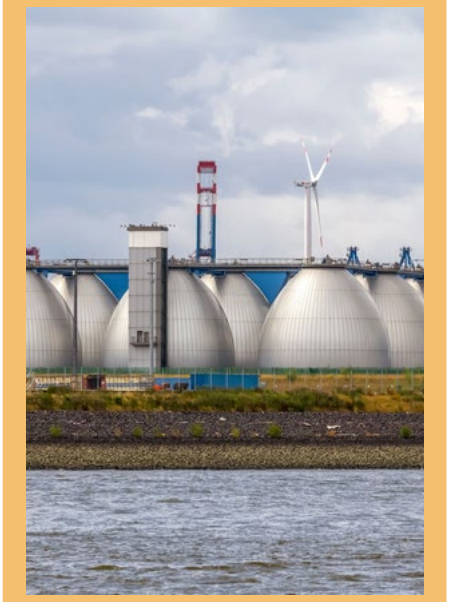
After you finish working on the map, try to go through each of these questions below to generate deep thinking and discussion among the team.

1. **Comparison with Master Diagram:** Does your freshwater ecosystem health model (diagram) look similar or different to the Master system diagram? How is yours different, and can you explain the difference a bit?
2. **New Insights:** In doing this activity, what new insights and thinking have come to you? What does doing this activity cause you to think about regarding freshwater ecosystem health?
3. **Challenges in Mapping:** What was challenging for you in putting together your own freshwater ecosystem health map from the cards (i.e., system elements) that you were given?
4. **Additional Elements:** Were there any new elements that you added to the model? Explain your thinking behind these additions.
5. **Leverage Points for Change:** When you think about making big changes in a system, like how things work in your community or even globally, we're curious to know where you think the best places to make those changes are. We call these spots "leverage points." They're like key places where even a small change can make a really big difference in how things work. So, where do you think these important spots are in your map? What makes them so crucial? And if you could make changes there, what kind of impact do you think it could have on your community or country?

Follow the link provided to learn more about Leverage Points: Leverage Points - Places to Intervene in a System (4.55 minutes)

Freshwater Ecosystems Mapping





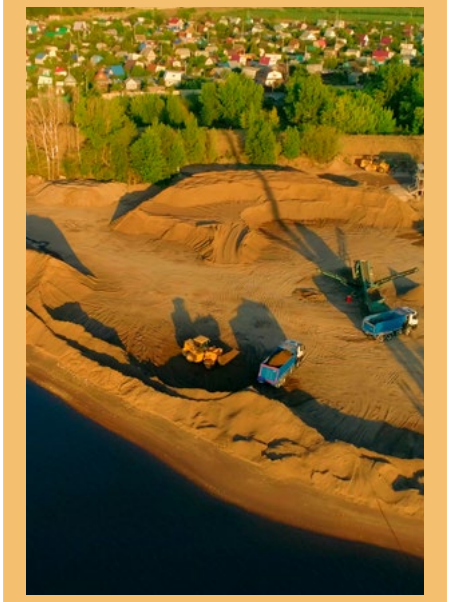
Water Withdraw

Flip me →

Economic Development

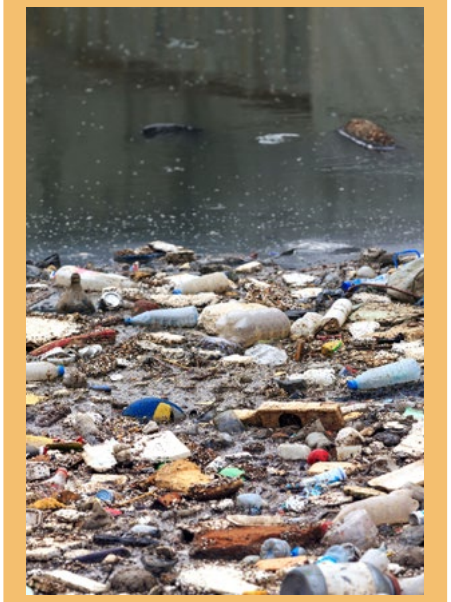
Industry, infrastructure, city, agriculture, mining, etc.

Flip me →



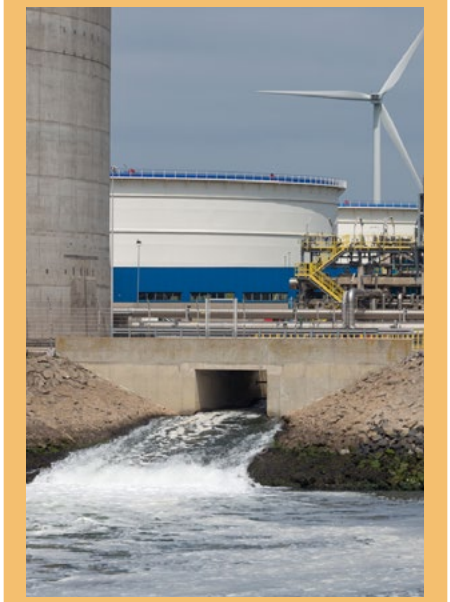
Habitat Encroachment

Flip me →



Water Pollution

Flip me →



Wastewater Discharge

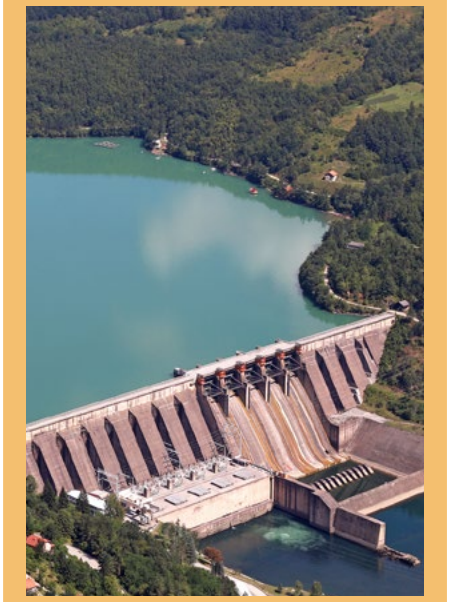
Flip me →

Government Policies, Planning and Regulations

Flip me →

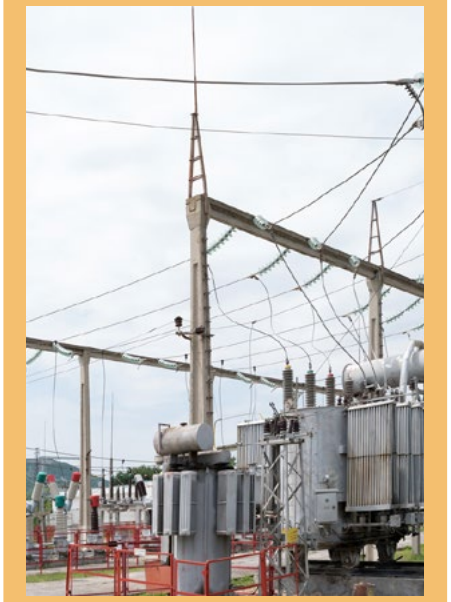
Climate Change

Flip me →



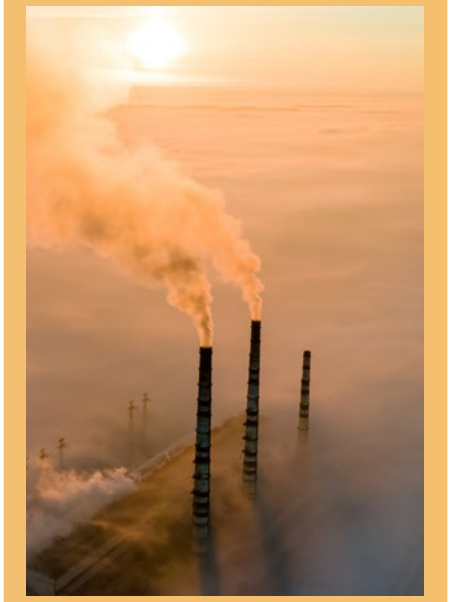
Hydropower Development

Flip me →



Energy Production

Flip me →



Greenhouse Gases (GHGS) Emissions

Flip me →

Water Discharge

Wastewater discharge resulting from economic development occurs when industrial, urban, and agricultural activities produce contaminated water that is released into freshwater sources. Rapid industrial expansion, urbanization, and intensive agricultural practices generate large volumes of wastewater containing pollutants such as chemicals, heavy metals,and nutrients.

Water Pollution

Water pollution resulting from **economic development** and **wastewater discharge** occurs when industrial, urban, and agricultural activities generate large volumes of contaminated water that are discharged into freshwater sources without adequate treatment.

Industrial expansion, urbanization, and intensive agricultural practices driven by economic growth produce pollutants such as chemicals, heavy metals, and nutrients, which degrade water quality and harm aquatic ecosystems.

Wastewater discharged from industries, urban areas, and agricultural fields carries these pollutants into rivers, lakes, and oceans, posing risks to human health, biodiversity, and ecosystem functionality.

Habitat Enroachment

Habitat encroachment significantly impacts the **health of freshwater ecosystems** by leading to habitat destruction, reduced biodiversity, and degraded water quality.

This fragmentation of habitats limits species movement and reduces genetic diversity, making ecosystems more vulnerable to environmental stresses. Overall, habitat encroachment undermines the stability and health of freshwater ecosystems, threatening their biodiversity and functionality.

Economic Development

(Industry, infrastructure, city, agriculture, mining, etc.)

Economic Development, through industrial expansion, urbanization, and intensive agriculture, requires excessive **water withdraw** and significantly contributes to water pollution. Industries **discharge of wastewater** with harmful chemicals into nearby water bodies, urban areas generate untreated or poorly treated sewage, and agricultural runoff carries fertilizers and pesticides into freshwater sources, causing nutrient pollution and contamination.

Habitat encroachment caused by **economic development** activities destroys and fragments wetlands, forests, and other critical areas, disrupting freshwater ecosystems and the species that depend on them.

Government policies and plans can drive **economic sector** to investments in eco-friendly infrastructure and sustainable agriculture, fostering economic growth while preserving freshwater ecosystems. Conversely, **government planning and policies** are also **influenced by economic considerations**, such as the need to balance environmental protection with economic development.

Water Withdraw

Excessive **water withdrawal** reduces river and stream flows, potentially causing water bodies to dry up during dry seasons. This not only affects the entire aquatic ecosystem but also undermines the overall **health of freshwater ecosystems**, leading to habitat loss and decreased biodiversity.

Extensive water withdrawal for agricultural irrigation and industrial use can significantly alter river flow, disrupting sediment transport patterns and impacting the geomorphology of riverbeds and deltas. These changes can adversely affect spawning grounds for fish and other aquatic organisms, further threatening the stability and diversity of freshwater ecosystems.

Greenhouse Gases (GHGS) Emissions

Energy production is the primary contributor to **greenhouse gas emissions**, which are a major driver of climate change.

Hydropower development is often promoted as a renewable energy source to mitigate **GHGs emissions** from fossil fuel-based power generation.

Energy Production

Energy production is driven by the **government policies and plans** as well as the **economic development**.

Depending on the energy mix, **energy production** can significantly **contribute to the GHGs emissions**.

Hydropower Development

Hydropower Development is promoted by the **government policies and plans** as part of a solution to reduce GHGs emissions and to ensure the **energy production** meet the demand side.

However, **Hydropower Development** has huge impacts on **habitat encroachment** during the construction and alter the water flow, which directly and indirectly undermine the **overall freshwater ecosystem**.

Climate Change

Greenhouse gas (GHG) emissions contribute to → **climate change**, prompting → **governments to implement policies** aimed at reducing emissions. In response, hydropower development is often promoted as a renewable energy source to mitigate GHG emissions from fossil fuel-based power generation.

On the other hand, **climate change** impacts **freshwater ecosystem health** by altering precipitation patterns, leading to changes in water availability and quality, and by increasing temperatures, which can disrupt aquatic habitats and biodiversity. These changes exacerbate existing stressors on freshwater ecosystems, threatening the survival of species and compromising ecosystem functioning.

Government Policies, Planning and Regulations

Government policies and plans profoundly influence **energy production** and **hydropower development**, to ensure the energy demand of the country is met.

Government policies and plans can drive **economic sector** to investments in eco-friendly infrastructure and sustainable agriculture, fostering economic growth while preserving freshwater ecosystems.

Additionally, the pressures of **climate change** drive **governments policies** to promote low carbon emissions by advocating for alternative energy sources like hydropower and enforcing stricter controls on business practices.

Food Security

Flip me →

Community Livelihood

Flip me →

Frequency of Flood and Drought

Flip me →

Health Risks

(waterborne diseases, chemical exposure)

Flip me →

Freshwater Ecosystems Health

Flip me →

Biodiversity

Flip me →

Frequency of Flood and Drought

The **frequency of floods and droughts** is impacted by the **health of freshwater ecosystems**, as healthy ecosystems regulate water flow, reducing the severity and occurrence of these extreme events.

When **floods and droughts** occur frequently, they devastate agricultural productivity, leading to food shortages and loss of income for farming communities, which compromises **food security** and disrupts **livelihood**.

Floods and droughts also damage infrastructure, reduce industrial output, and strain resources, thereby hindering overall **economic development** and stability.

Community Livelihood

Community livelihood is significantly impacted by increased **health risks** and the **frequency of floods and droughts**, which disrupt agricultural productivity, living conditions, and overall **community livelihood**.

Additionally, biodiversity loss threatens **food security**, further affecting the **community livelihood**.

Food Security

Food security is impacted by **biodiversity loss**, as it reduces the availability of diverse crops and livestock, weakening ecosystem resilience and agricultural productivity. The increasing **frequency of floods and droughts** further disrupts **food production**, exacerbating food shortages and threatening community stability.

Food security impacts **economic development** by influencing the stability and productivity of urban, industrial, and agricultural sectors; reliable food sources support a healthy workforce and stable markets.

Food security contributes to the **community livelihood** by ensuring consistent access to nutritious food, which is essential for health, productivity, and overall well-being, reducing poverty and enhancing quality of life.

Biodiversity

Biodiversity is negatively influenced by **habitat encroachment** and the **health of freshwater ecosystems**, as habitat loss and degradation reduce species diversity and ecosystem resilience.

Healthy **biodiversity** supports **community livelihood** by providing essential resources, ecosystem services, and opportunities for sustainable economic activities.

Freshwater Ecosystems Health

The **health of freshwater ecosystems** depends on the impacts of **climate change, wastewater discharge, water pollution, habitat encroachment**, and **hydropower development.**

Freshwater ecosystem health determines **biodiversity status**, regulates water flow to help control **floods and droughts**, supports **community livelihood**, and reduces **health risks** from waterborne diseases and chemical contamination.

Health Risks

(waterborne diseases, chemical exposure)

Health risks such as waterborne diseases and chemical exposure are influenced by the **health of freshwater ecosystems**; degraded ecosystems lead to contaminated water, increasing these risks.

These **health risks** negatively impact **community livelihood** by causing illness, reducing productivity, and increasing healthcare costs.

Write an element here

Additional Element

Write an element here

Additional Element

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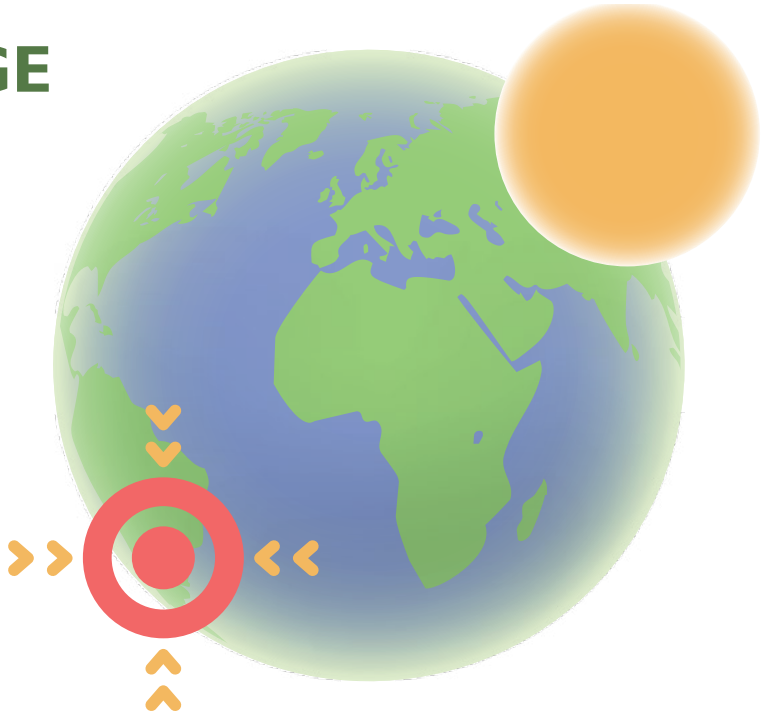
1.2.1

CLIMATE CHANGE WITNESSES



Changes in temperature, precipitation, and extreme weather all affect ecosystems, which in turn affect the people dependent on natural resources for food production, as well as their jobs and traditional livelihoods.

In recent decades, science has documented many observed changes in climate and their associated impacts. At the local level, changes can be small and imperceptible at first, but over time, can be quite major. Usually people don't tend to notice change unless they are asked to reflect on the past in comparison to the present.

Age Group: 15 years old and above

Time Required: 2-3 hours depending on the extent of interview your team would like to do

Group Size: Small group of 4-6 people

Materials:

1. A notebook with pens or pencils
2. Handouts (interview forms)

Activity Objectives/Participants will...

- Observe and analyze the changes in the community over time as a result of climate change;
- Develop an understanding of the impacts of climate change on a specific community.

YOUR ASSIGNMENT

Your assignment is to c**ollect information from local people in your community about the changes that they may have perceived over their lifetime in relation to climate change.** You should primarily interview at least 5-10 older residents in the community as they will have lived long enough to have witnessed any changes that may have occurred.

When your interview is completed, share the stories with others by writing an engaging story, creating a PhotoVoice with captions or developing a mind map with a video explaining the story.

Need more tips? *Visit Chapter 2 Developing an Advocacy Position to see some tips on how to conduct information interviews.*

CLIMATE CHANGE WITNESSES INTERVIEW FORM

Follow the Interview form outlined here with all of your interviewees.

Name: _____ **Age:** _____ **Occupation:** _____

Address: _____

Telephone no.: _____

How long have they lived in this community: _____

Questions:

1. **What changes in the local climate have you noticed during your lifetime in our community?** Describe.

_____

_____

_____

2. **Have you witnessed any changes in average seasonal temperatures over your lifetime for the same time of year?**

Yes ☐ No ☐ **If yes:** **Higher temperatures** ☐ **Lower temperatures** ☐

Explain:

_____

_____

_____

3. **Have you witnessed any noticeable changes in rainfall over your lifetime in this region of the country?**

Yes ☐ No ☐ **If yes:** **Increase in annual rainfall** ☐ **Decrease in annual rainfall** ☐

Explain:

_____

_____

_____

4. **Have you witnessed any noticeable increase in extreme weather events over your lifetime in this region of the country, such as significant flooding, prolonged drought, or heatwave?**

Yes ☐ No ☐

Explain:

_____

_____

_____

5. **Have you witnessed any noticeable changes in the water levels and flows of the local rivers, streams and canals in our area over your life time?**

Yes ☐ No ☐

Explain:

_____

_____

_____

6. **Have you witnessed any noticeable changes in plant and animal species in our area over your lifetime?**

Yes ☐ No ☐

Names of some plant species: _____

Names of some animal species: _____

Explain:

_____

_____

_____

7. **Have there been any personal impacts on your own life from climate change?**

Explain:

_____

_____

_____

MY CLIMATE CHANGE WITNESS ARTICLE/STORY

Headline: _____

My Thoughts and Feelings After Completing This Assignment:

1.2.2

CLIMATE CHANGE MAPPING

Developing a visual representation of climate change processes and linkages map can deepen your comprehension of the causes and effects of climate change and highlight the intricate connections among its various elements. This improved understanding of climate change is crucial for making informed decisions when addressing this global challenge.

Age Group: 15 years old and above

Group Size: This activity can be done individually or in small group up to 6 people maximum. If there are more people, please consider to make more groups.

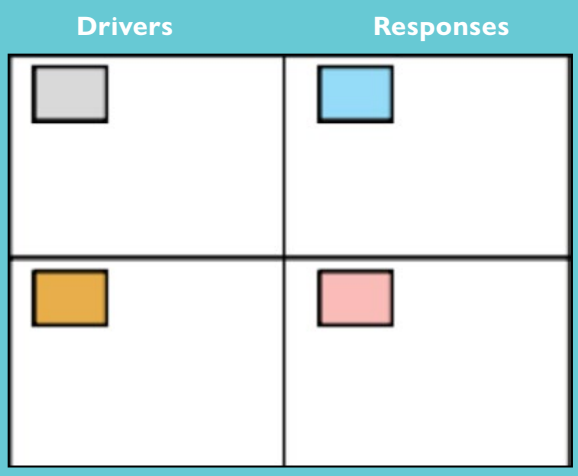
Time Required: 45-60 minutes

Materials:

1. **Print out the provided visual elements on A4-size paper, double-sided, and proceed to cut them into individual pieces. Sort them out by color (border color).**
    - The card set contains 4 different colors of cards. **Blue** represents the climate change responses, **Pink** represents the impacts from Climate Change, **Grey** represents the Climate Change's secondary Drivers, and **Yellow** represents primary root cause human activities that drive Climate Change.
    - Each card should feature a picture with a corresponding title on the front side, while the back side should contain a text explanation corresponding to that specific title.
2. **Prepare a big flipchart paper and markers. Fold the flipchart paper to divide the paper space into 4 quadrants. If only small-sized flipchart available, you may consider put 2 flipcharts together.**

ACTIVITY INSTRUCTIONS

1. Place flipchart paper on a smooth surface / table.
2. Place the stack of cards on each quadrant of the paper according to color designated (see picture on the right).
3. First, participants are encouraged to work on the 2 quadrants (blue and pink) on the right side of the paper (Responses and Impacts of Climate Change). Once done, the participants can work on the other cards on the left side of the flipchart paper (Drivers).



Note: You do not have to start working on the ***"Responses and impacts"*** side. Feel free to choose the starting point that makes the most sense for you and your team.

4. Start by putting the blue card, titled **"Average Global Temperature",** on the flipchart and identify the cause-and-effect relationships of this card with the other cards in blue and pink colors.
5. Draw an arrow between the 2 interconnected elements to illustrate its directional cause and effect relationship. For example, **Average Global Temperature → Ice Cap Melting.**

Note: More information provided on the back of each card. If you get stuck in identifying the cause and effect relationship among these cards, flip the card to read the information provided.

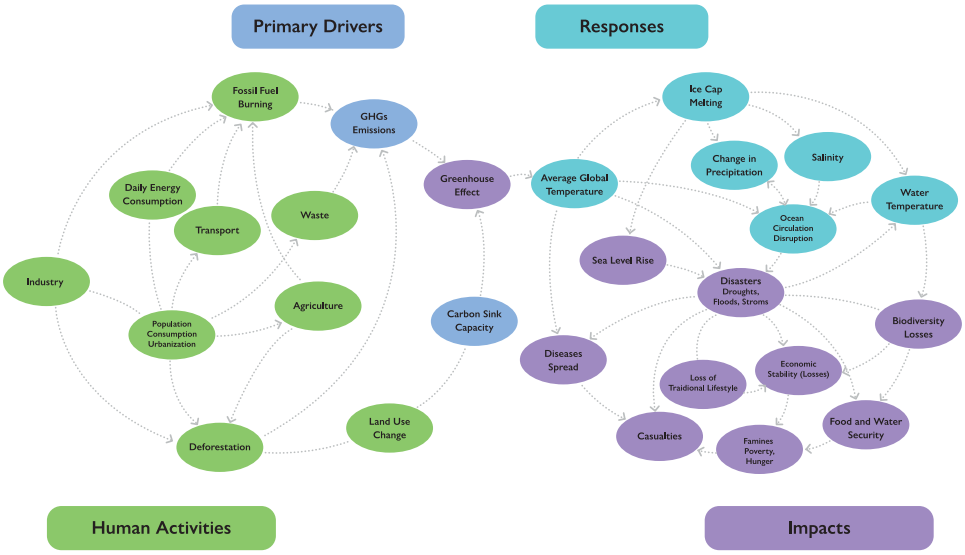
6. Continue to identify the cause-effect linkages between different elements and draw directional arrows to indicates their causal relationships. If you think some elements are missing from this set of cards or, if you would like to add more details, please write down the additional elements on the blank cards provided and include them in your system map.
7. When you are satisfied with the map of the Climate Change Responses and Impacts (right side of the paper), go ahead and work on the "**Drivers of Climate Change**" (left side of the paper), with the card set in grey and yellow colors.

Note: There are some blank cards provided in this card deck. The purpose of having the blank cards are to allow you to expand your view and make connections between climate change and your topic of interest. During the activity, you can add new cards at anytime. It is also ok if you or your group do not use some of the existing cards, if you think these cards are not fit into the conceptual picture.

The system diagram provided on the next page (see picture below) is intended to be used as a guide. It is totally fine if your final map does not look exactly the same with this one. What matters is the conversation / discussion you have with the group.

Master Answer Key

Do not worry if your map does not look exactly like the answer key. What is the most important is the learning and the understanding of the interconnections between different elements in this system map.

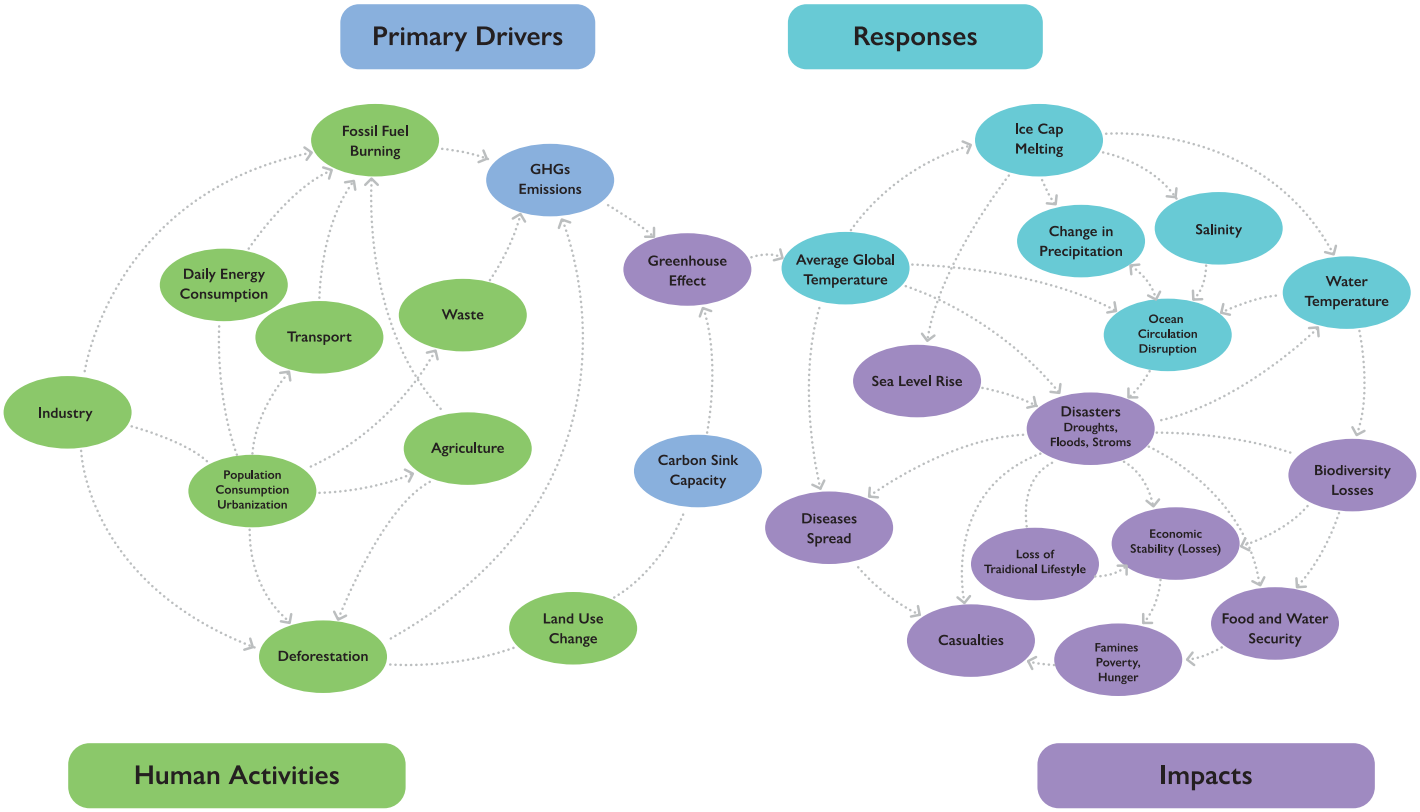


CLIMATE DIAGRAMMING ANALYSIS AND DEBRIEF QUESTIONS

After you finish working on the map, try to go through each of these questions below to generate deep thinking and discussion among the team.

1. Does your Climate Change system model (diagram) look similar or different to the Master system diagram? How is yours different and can you explain the difference a bit?
2. In doing this activity, what new insights and thinking have come to you? What does doing this activity cause you to think about?
3. What was challenging for you in putting together your own Climate Change system map from the cards (i.e. system elements) that you were given?
4. Were there any new elements that you added to the model? Explain your thinking.
5. On the effects side of the diagram, which of the system elements do you feel is the lynchpin for the severity and extent of climate change impacts on human societies, especially looking to the future?
6. When you think about making big changes in a system, like how things work in your community or even globally, we're curious to know where you think the best places to make those changes are. We call these spots "leverage points." They're like key places where even a small change can make a really big difference in how things work. So, where do you think these important spots are in your map? What makes them so crucial? And if you could make changes there, what kind of impact do you think it could have in your community or country?

Climate Change Mapping



Adapted from: An Analysis of Opportunities for USAID Indonesia's Water and Energy Team to Incorporate Global Climate Change Activities in the Natural Resource Management and Energy Sectors, December 2008

Deforestation

Flip me →

Population, Consumption, Urbanization

Flip me →

Land Use Change

Flip me →

Industry

Flip me →

Agriculture

Flip me →

Transport

Flip me →

Land Use Change

Forests act as carbon sinks by absorbing and storing large amounts of CO2 through photosynthesis. Trees capture carbon and release oxygen, contributing to the global carbon cycle.

When forests are cleared during **deforestation**, causing **land use change** and thus **carbon sink capacity** is lost.

Also the process of deforestation, especially through burning, releases stored carbon in the form of CO2 back into the atmosphere. This contributes to **increased greenhouse gas** concentrations and exacerbates climate change.

Population, Consumption, Urbanization

As the world population increases, **residential demand** for energy increases (cooking, heating, colling and lighting).

To build habitat for people, building more roads and other infrastructures also caused **deforestation**.

When cities grow really fast, they need even more energy for **transportation**, **industry** as well as **agricultural** activities.

Deforestation

The conversion of land from a forested state to another land use type (such as **agriculture**, **urbanization**, **industry** and/or infrastructure development) constitutes a significant **change in land use.**

Transport

Cities in Asia expand rapidly,thus there is a simultaneous development of extensive road networks, leading to a greater dependence on both public and private transportation.

The **increasing urban populations** contribute to heavy traffic, causing congestion, longer duration of **transportation** and raising reliance on **fossil fuels burning** like gasoline and diesel.

Agriculture

As the **global population increases**, the demand for food rises, thus there may be increased pressure to convert natural ecosystems, e.g. forests, into **agricultural** land thus causing **deforestation**.

To maximize food production, there's often an intensification of agricultural practices, involving the use of fertilizers, pesticides, and machinery, which often rely on **fossil fuels**. The use of fossil fuels in agriculture contributes to greenhouse gas emissions.

Methane emissions from flooded rice paddies are a significant GHG emission source in Asia.

Industry

The modern **consumption patterns** around the world drive the need for more resources, land, energy, and products, thus **industry** increases their activities. The needs for more resources caused more **deforeststation** for agriculture or logging, and using more energy in their services and production process is produced daily from **fossil fuels.** Additionally, the production and transportation of goods contribute to carbon emissions.

Daily Energy Consumption

Flip me →

Waste

Flip me →

Fossil Fuel Burning

Flip me →

Greenhouse Gases(GHGS) Emissions

Flip me →

Carbon Sink Capacity

Flip me →

Greenhouse Effects

Flip me →

Fossil Fuel Burning

Daily energy consumption, **agriculture** activities, **transportation**, and **industry**, require use fossil fuels like coal, oil, and natural gas for things like it creates a lot of smoke and releases **Greenhouse gases** into the atmosphere.

Waste

As the world **population** increases, we use up more resources, which results in more **waste** being produced. When waste isn't managed properly, such as by dumping it openly or burning it, it adds even more **greenhouse gases** to the atmosphere, worsening climate change.

Daily Energy Consumption

(lighting, heating, cooling, cooking, etc.)

Urbanization, consumption, and population growth are significantly increasing our **daily energy consumption**. This surge in energy demand is largely fulfilled by **burning fossil fuels** like coal, oil, and natural gas, which are major contributors to environmental problems such as air pollution and climate change. As cities expand, people consume more goods and services, and the global population grows, our reliance on these fossil fuels intensifies, perpetuating a cycle of environmental degradation.

Greenhouse Effect

The greenhouse effect is a natural process that warms the Earth's surface. When the sun's energy reaches our planet, some of it is reflected back to space, and the rest is absorbed and re-radiated by greenhouse gases in the atmosphere.

However, human activities, such as burning fossil fuels and deforestation, have reduced the **carbon sink capacity**, and **increase the concentration of greenhouse gases**, thus enhancing the natural **greenhouse effect**. This extra warming contributes to climate change, with consequences such as **rising the average global temperatures**.

Carbon Sink Capacity

Forests, oceans, and other natural areas are like super-sized sponges that absorb a lot of carbon dioxide. This sponge is what we call a "carbon sink."

With **landuse changes** (from urbanisation, deforestation, etc.), the **Carbon sink capacity** is reduced. This means the earth can't absorb as much carbon dioxide, and more of it stays in the air. This extra carbon dioxide contributes to the **greenhouse effect**, making our planet warmer than it should be.

Greenhouse Gases (GHGS) Emissions

Imagine the Earth as a cozy blanket that keeps us warm by trapping some of the sun's heat. This natural warmth is a good thing because it makes our planet just right for living.

Burning of **fossil fuels** like coal, oil, and gas, **deforestation** and improper **waste** management contribute to more greenhouse gases emissions. Instead of just keeping the right amount of warmth, these extra layers make the blanket too thick. This thickening is what we call the **greenhouse effect**. It traps too much heat around the Earth, making it warmer than it should be.

Average Global Temperature

Flip me →

Ice Cap Melting

Flip me →

Salinity

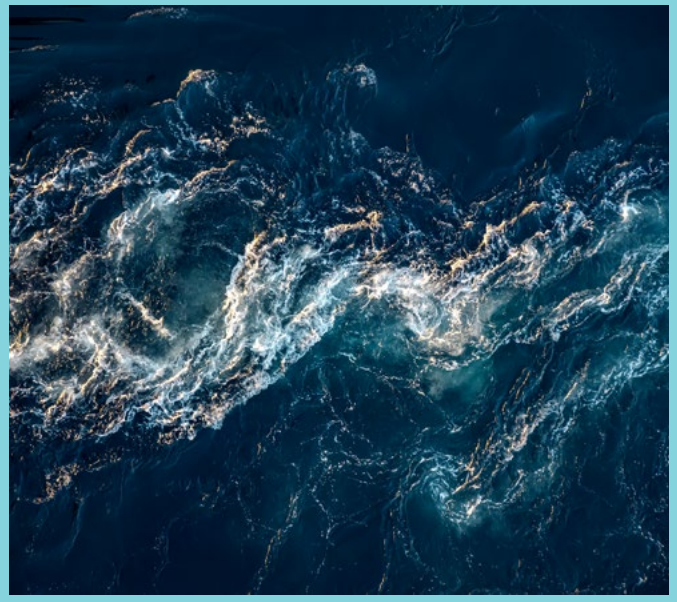
Flip me →

Water Temperature

Flip me →

Change in Precipitation

Flip me →



Ocean Circulation Disruption

Flip me →

Salinity

Ocean salinity, or the concentration of salt in seawater, is a crucial factor influencing ocean circulations / currents.

As **ice caps and glaciers melt**, they release freshwater into the oceans, altering the usual balance of salt and freshwater. Changes in **ocean salinity** impact the density and buoyancy of seawater. In turn, these changes can influence the patterns of **ocean currents/ circulation.**

Reduced salinity in certain areas can disrupt the normal functioning of currents like the Atlantic Meridional Overturning Circulation (AMOC), which plays a key role in redistributing heat globally.

Changes in ocean currents can further influence regional and global climate patterns, affecting weather systems, sea surface temperatures, and precipitation.

Ice Cap Melting

The **rising global average temperature** is a key factor contributing to the **melting of ice caps** and glaciers around the world. As Earth's temperature increases, it leads to the warming of the atmosphere and oceans. This warmer climate results in the melting of ice caps, glaciers, and polar ice sheets.

Average Global Temperature

The increased concentration of greenhouse gases such as carbon dioxide and methane in the atmosphere enhance the **greenhouse effect**. These gases act as a kind of insulating layer around the Earth, trapping heat and causing the **average global temperature** to rise.

This extra warming contributes to climate change, with consequences such as **melting ice caps, disrupting Ocean Circulation**, more climate-related **disasters**, and more s**pread of diseases**.

Ocean Current Circulation Disruption

Changes in **average global temperature, water temperature, salinity, and precipitation patterns** can significantly influence **ocean current circulation**.

Disruptions in ocean current circulation can contribute to a range of **natural disasters** with significant impacts on both human and environmental systems.

Disruptions in ocean current circulation can alter weather patterns, leading to more frequent and severe storms. Additionally, disruptions in ocean circulation can impact marine ecosystems, affecting the distribution of nutrients and leading to declines in fish populations. Furthermore, changes in ocean currents can influence sea level rise and coastal erosion, exacerbating the risk of flooding and coastal inundation events.

Change in Precipitation

The **melting of ice caps** plays a crucial role in **changing precipitation patterns** on a global scale.

As **ice caps and glaciers melt** due to rising temperatures, they release substantial amounts of freshwater into the oceans. This influx of freshwater can disrupt established **ocean circulation** and affect the distribution of heat around the globe.

Changes in ocean circulation patterns, such as the Atlantic Meridional Overturning Circulation (AMOC), can **influence atmospheric circulation and precipitation**.

Water Temperature

The **melting of ice caps** impacts **ocean water temperature** primarily through the introduction of freshwater into the oceans. Ice caps, especially those in polar regions, store vast amounts of freshwater in the form of ice. As these ice caps melt due to rising temperatures, the freshwater is released into the surrounding seas. The influx of freshwater from melting ice alters the density and salinity of the oceans, impacting **ocean circulation patterns**.

When **droughts** occur, they can cause the **water temperature** in rivers, lakes, and other bodies of water to rise. This rise in temperature can have far-reaching consequences for **biodiversity**, the variety of life in a particular habitat.

Disasters (floods, droughts,storms, etc.)

Flip me →

Diseases Spread

Flip me →

Famines

Flip me →

Casualties

Flip me →

Economic Stability (Losses)

Flip me →

Biodiversity Losses

Flip me →

Famines

Famine is a severe scarcity of food that leads to widespread hunger, malnutrition, and sometimes even starvation among a large population.

Climate change-induced **disasters (flood, droughts, extreme weather patterns)** have devastating effects on both **economic stability** (Economic loss) and **food and water security**, often exacerbating conditions that lead to **famine**.

Famines are intricately linked to **casualties** as the severe shortage of food and nutritional deficiencies directly jeopardize the health and survival of populations. In extreme cases, famine can result in a significant number of casualties due to starvation, weakened resistance to illnesses, and inadequate access to medical care.

Diseases Spread

Warmer temperatures contribute to the expansion or **spread of diseases**, vectors such as mosquitoes and ticks extending their geographic range. In areas where these vectors transmit diseases like malaria, dengue fever, Zika virus, and Lyme disease, the prolonged warmer seasons create favorable conditions for these disease carriers to thrive and spread illnesses to new regions.

Additionally, the rising frequency and intensity of **natural disasters** pose threats to public health infrastructure, displacing populations and creating environments conducive to the **spread of diseases**.

Spread of diseases are intricately linked to **casualties**.

Disasters (Floods, droughts,storms, etc.)

Natural disasters have far-reaching impacts, causing **loss of lives (casualties), economic losses** through damage to infrastructure and disruption of supply chains but also creating conditions for the **spread of diseases** by disrupting public health infrastructure and displacing populations.

Additionally, these disasters contribute to **biodiversity loss** through habitat destruction and harm to species, disrupting ecosystems (such as increasing **water temperature**, dry up water bodies, etc).

Furthermore, they can disrupt **traditional lifestyles** by damaging homes, eroding cultural landscapes, and undermining community structures, compelling affected populations to adapt and often resulting in the loss of cultural practices and heritage.

Biodiversity Losses

Climate-related disasters, including storms, floods, and extreme weather events, exert direct and indirect impacts on ecosystems, their inhabitants and **biodiversity**.

While the rise in ocean **water temperatures** directly affects marine habitats, leading to coral bleaching, coastal ecosystem destruction, and species displacement, disrupting normal life cycles, impairing reproduction, and contributing to population declines, **biodiversity losses** and the potential extinction of vulnerable species.

Biodiversity loss significantly impacts **food and water security** by disrupting ecosystems, leading to decreased crop yields, increased vulnerability to pests and diseases, and limiting dietary diversity, while also undermining water regulation, purification, and availability for drinking, irrigation, and fisheries, affecting the livelihoods of millions of people globally.

Economic Stability (Losses)

Climate-related natural disasters, such as storms, floods, or droughts can cause destruction of infrastructure and **economic assets**, leading to significant economic losses for affected communities. Simultaneously, these events often result in the **loss of traditional lifestyles** as homes are destroyed, cultural landscapes erode, and community structures are undermined. As people adapt to the aftermath, the **economic loss** continues with the displacement of populations and the need for costly recovery efforts.

Biodiversity loss and declining essential ecosystem services like pollination, water purification, and disease regulation diminish due to climate change, impacting various sectors of the **economy** dependent on these services.

Casualties

Climate-related **natural disasters** can lead to a chain of interconnected challenges, resulting in **casualties**. These events, such as storms, floods, and droughts, can cause immediate casualties through physical harm and displacement.

Additionally, the breakdown of infrastructure and sanitation systems during disasters creates conditions conducive to the rapid **spread of diseases**, further increasing casualties.

The long-term impacts of such disasters on agricultural systems often contribute to **famines**, as crop failures and food shortages exacerbate food insecurity, leading to malnutrition and, in severe cases, starvation-related **casualties**.

Food and Water Security

Flip me →

Loss of Traditional Lifestyle

Flip me →

Sea Level Rise

Flip me →

Sea Level Rise

Ice caps melting, particularly those in polar regions and glaciers, they contribute freshwater to the oceans, leading to an **increase in sea levels**.

As the sea level increases, it can lead to **flooding**, erosion of coastlines, and saltwater intrusion into freshwater sources.

Loss of Traditional Lifestyle

Climate-related **natural disasters** significantly impact **traditional lifestyles** by causing widespread disruptions to communities' cultural practices, livelihoods, and socio-economic structures. Events such as storms, floods, or droughts can result in the destruction of homes, agricultural lands, and vital resources, forcing populations to adapt to new, often unfamiliar conditions.

The **loss of traditional landscapes** and natural resources can undermine customary activities like agriculture, or fishing, leading to **economic instability** and altering social structures.

Additionally, the displacement of communities and the destruction of infrastructure during these disasters often challenge the resilience of traditional ways of life, as individuals and societies must cope with the aftermath and navigate the complexities of recovery.

Food and Water Security

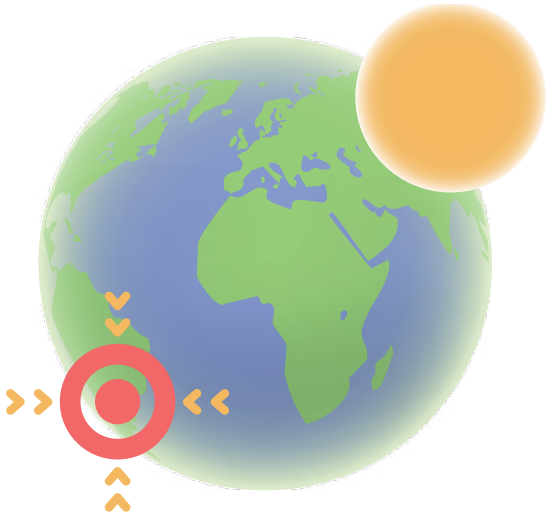
The decline in **biodiversity** undermines agricultural productivity and **food security**, as diverse ecosystems contribute to pollination, soil fertility, and natural pest control.

Climate-related **disasters**, such as storms and extreme weather events, exacerbate these **food security** challenges by directly affecting crop yields and the overall stability of agricultural systems.

Simultaneously, healthy ecosystems regulate the water cycle, ensuring water availability and quality. The loss of biodiversity, coupled with climate-related events, disrupts this regulation, leading to water scarcity and compromising the reliability of water sources for both agriculture and human consumption.

1.2.3

IMPACTS OF CLIMATE CHANGE



The understanding of the potential hazards and impacts of climate change on communities is vital for numerous reasons.

Firstly, it facilitates risk assessment and preparedness, enabling proactive planning to mitigate potential damages and disruptions to local environments, infrastructure, and economies.

Secondly, it aids in protecting human health by identifying and addressing heightened risks such as heat-related illnesses and air pollution.

Additionally, it supports economic resilience by recognizing the potential of climate-related events to disrupt local economies, allowing communities to diversify, invest in resilient infrastructure, and support affected businesses.

The understanding of these impacts also guides efforts to preserve natural resources, promote social equity and justice, inform policy development, engage and educate communities, and foster long-term resilience and sustainability. In essence, this understanding forms the basis for informed decision-making, effective policies, and collaborative action to address climate change's multifaceted impacts.

Note: Hazards in the context of climate change encompass a range of environmental threats exacerbated by shifting climatic conditions. These include extreme weather events like hurricanes, floods, and heatwaves, as well as rising sea levels, temperature extremes, and altered precipitation patterns. Climate change also intensifies risks such as wildfires, vector-borne diseases, food and water insecurity, and biodiversity loss.

Age Group: 15 years old and above
Time Required: 1-2 hours to identify the hazards and impacts of Climate Change
1-2 hours to create the comic strip
Group Size: Any size. Small groups will encourage more participation
Materials:

1. Hazards and Impacts of Climate Change worksheet/handout
2. Big piece of paper for comic strip
3. Pen, pencils and color for comic strip creation

Activity Objectives/Participants will...

- Develop an understanding of the impacts of climate change on different aspects of the community.
- Be able to communicate these issues using various mediums, such as comic strips.

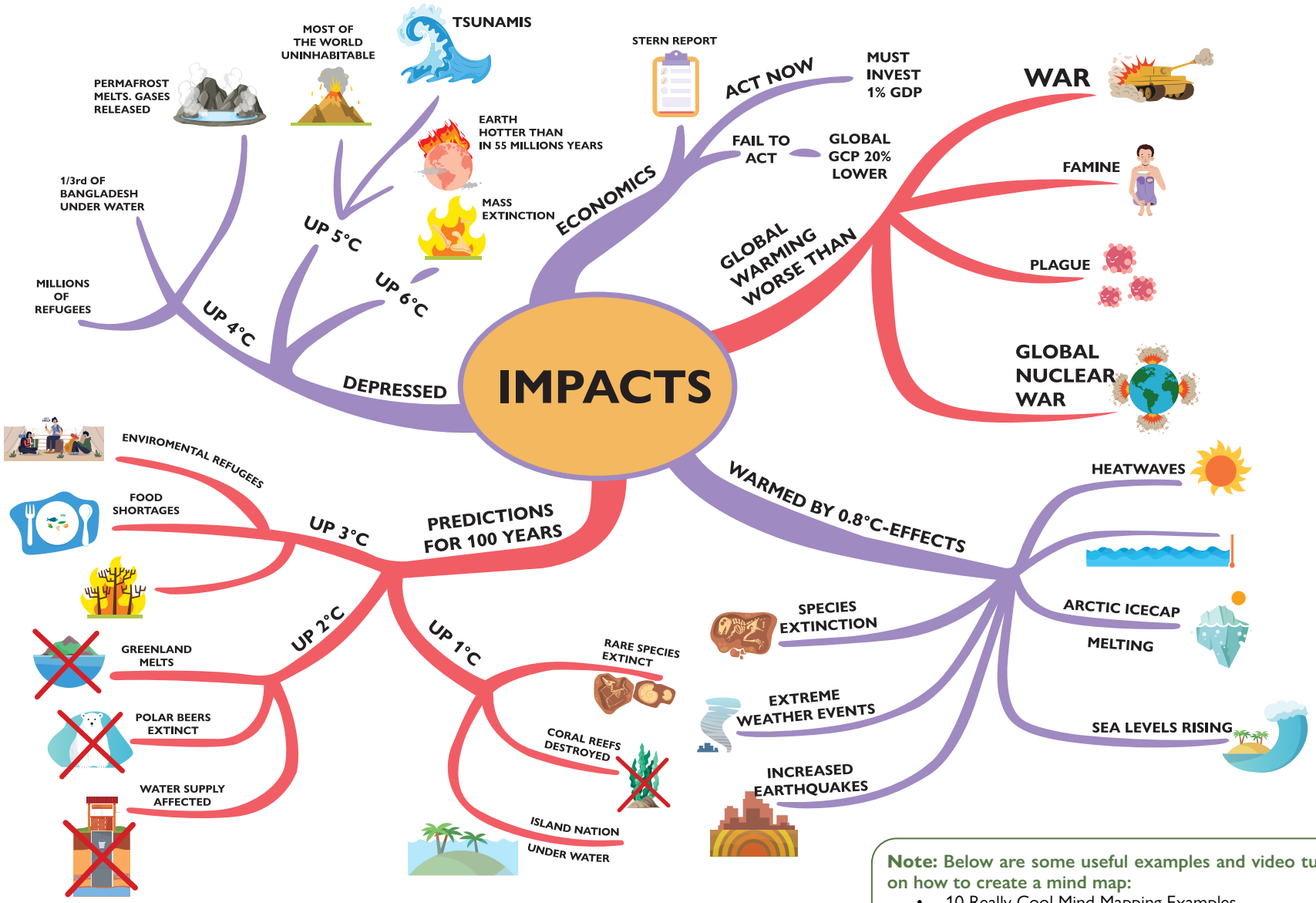
YOUR ASSIGNMENT

1. Using different sources of information that you have an access to, find more information about the impacts of climate change to different aspects of your community and briefly summarize what you found on the worksheet provided. Write your answers inside the clouds shown in the graphic.
2. Following from your research, create a comic strip based on your understanding of the impacts of climate change on your community. Develop one or two interesting characters & a storyline that takes into account the story's background context, includes aspects of the local lifestyle and dramatic events or conflicts that may have developed as a result of climate change. Use the seven comic strip panels provided to make your comic story.

Need to learn "How to Create a Comic Strip"? Follow this link.

CLIMATE CHANGE AND GMS

Countries in the Greater Mekong Subregion are particularly vulnerable to the impacts of climate change. Among the effects of climate change expected in the GMS are those experienced in other similar parts of the world such as...



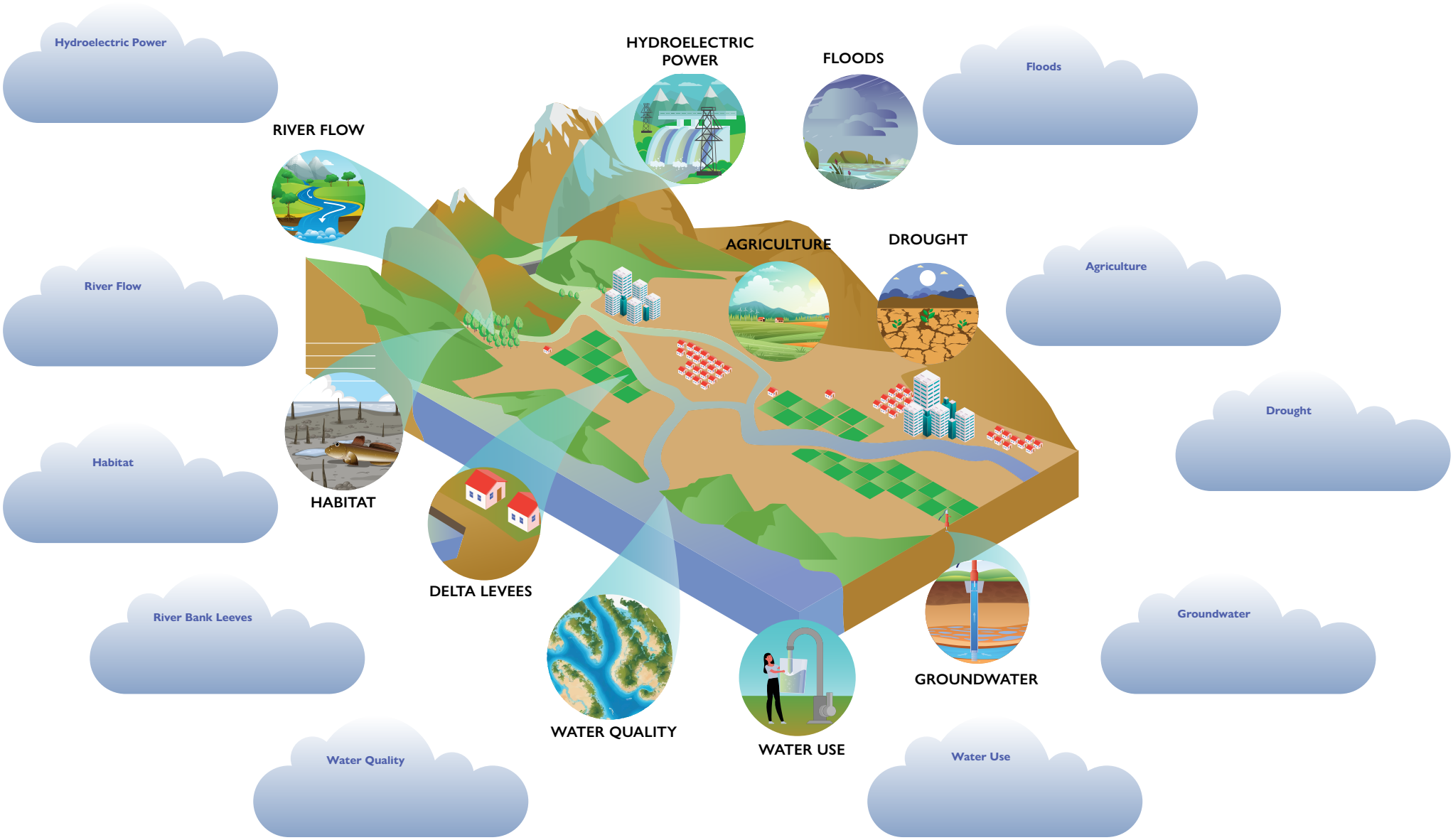
Note: Below are some useful examples and video tutorials on how to create a mind map:

- 10 Really Cool Mind Mapping Examples
- Step by Step directions for creating a mind map
- Miro Mind Mapping Tutorial

YOUR ASSIGNMENT

Using different sources of information that you have an access to, find more information about the impacts of climate change to different aspects of your community and briefly summarize what you found on the worksheet provided. Write your answers inside the clouds.

Hazards and Impacts of Climate Change



Climate Impacts Comic Strip

INSTRUCTIONS

Following from your research, create a comic strip based on your understanding of the impacts of climate change on your community.

Try to create one or two interesting characters & a storyline that takes into account the story's background context, includes aspects of the local lifestyle and dramatic events or conflicts that may have developed as a result of climate change. Use the seven comic strip panels to make your comic story.

My Thoughts and Feelings After Completing This Assignment:

1.2.4

CLIMATE CHANGE ACTION

Age Group: 15 years old and above

Group Size: This activity can be done individually or as a small group

Time Required: 60-90 minutes for mind mapping and 30-45 minutes on action plan

Materials:

1. Flipchart or other large sheet of paper, markers, and pastels
2. Climate Change Action Plan Template

Activity Objectives/Participants will...

- Gain a comprehensive understanding of various actions that can contribute to solving the climate change problem.
- Learn to create a mind map to explore and organize potential actions against climate change.
- Improve the ability to communicate complex issues related to climate change in a clear, organized, and visually appealing manner.
- Develop a sense of personal responsibility and commitment to implementing the identified climate action strategies.

YOUR ASSIGNMENT

- Creating a **"mind map" of how you can help to mitigate the climate change problem** we now face.
- Pick the top five ways that you will focus on in the coming year.

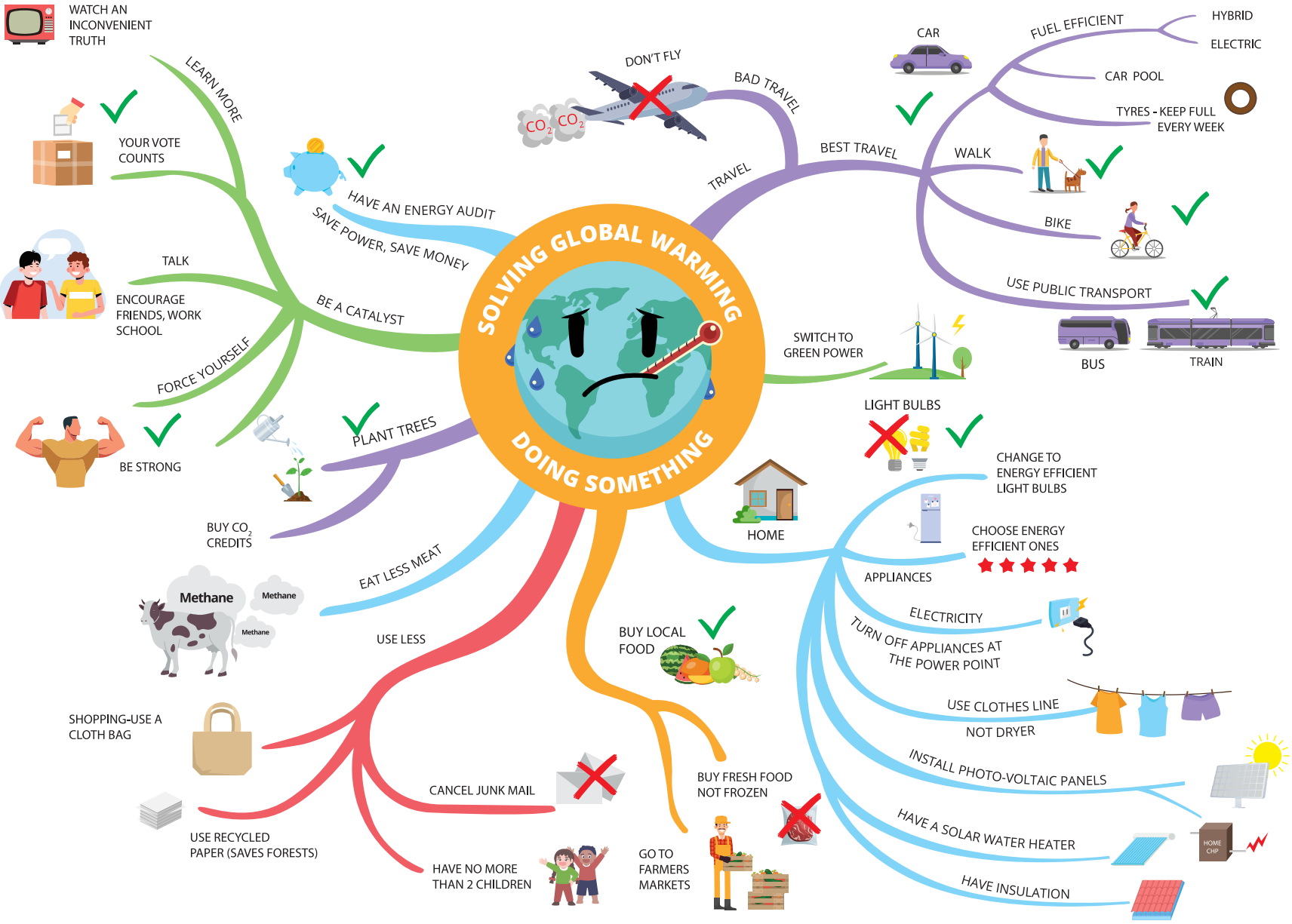
Creating a mind map is quite simple, just follow the simple steps described here...

- First, write your main issue, "Climate Action" in the center of a flipchart or other large sheet of paper.
- Next, think of as many key categories of actions that you could take, such as transportation choices, habits and practices, friends, home, etc.
- Progressively branch out from each main category into smaller, or more specific types of actions that you can do.
- When you construct your mind map, remember to be as creative and artistic as possible. Make it colorful and engaging!
- You can create a mind map on paper or electronically using templates available online for computers or tablets.

Note: Below are some useful examples and video tutorials on how to create a mind map:

- 10 Really Cool Mind Mapping Examples
- Step by Step directions for creating a mind map
- Miro Mind Mapping Tutorial

Example of Climate Change Action Mind Map



See an example of the climate change action mind map above for some ideas. However, please try to develop your own ideas. It will only really make a difference if the contents of the mind map come from your own ideas and feelings.

Once you have finished with the mind mapping, use the "My Climate Change Action Plan" template provided on the next page to make a list of the action items you would like to focus on for this year.

MY CLIMATE CHANGE ACTION PLAN

Based on the potential action items that you have brainstormed on the mind map, select five or more action items that you would like to do this year and use the template provided below to help you create your action plan.

IT IS TIME TO CREATE YOUR CLIMATE CHANGE ACTION PLAN

Action You Want to Focus on This Year	What Help Is Needed?	Possible Obstacles	How Will You Know You Are Successful?
(Example) Turn off the lights when I leave the room	• Place reminder sign on the door. • Ask for reminders from my family and friends	Forgetfulness and laziness	Unit of electricity saved on the monthly bill

1.3.1

ENERGY QUIZ 1

POWER GENERATION

Electric power can be generated from various types of fuel sources.

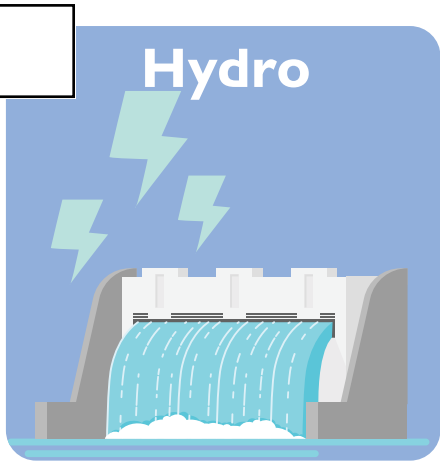
Rank power generation in your country by which fuel sources it uses most.

Example:

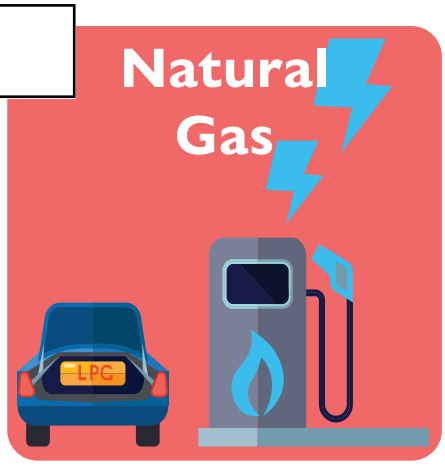
- Highest share = 1
- Lower shares = 2, 3, 4, etc.

Mark ⓧ if you think that particular sources are not used to generate power for your country.

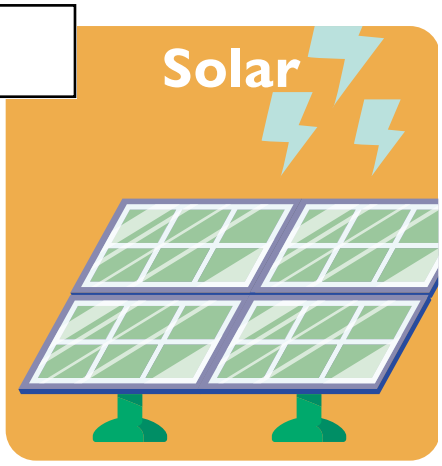
☐ Hydro



☐ Natural Gas

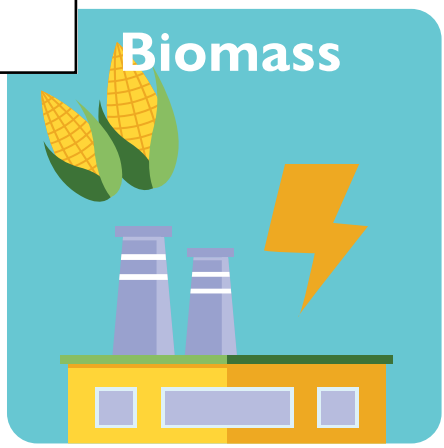


☐ Solar

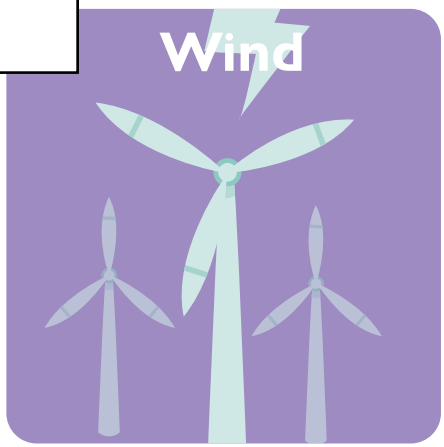


☐ Coal

☐ Biomass



☐ Wind

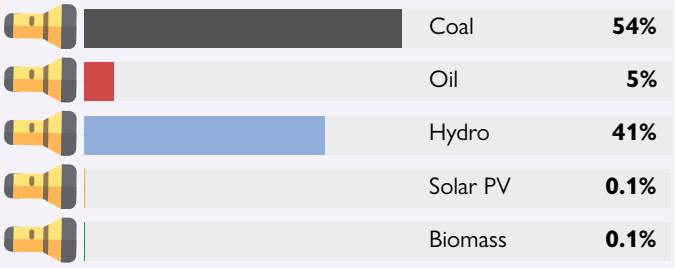


☐ Other Renewable Energy

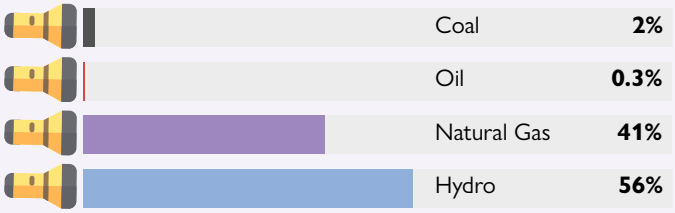
Check your answers →

POWER GENERATION
BY COUNTRY

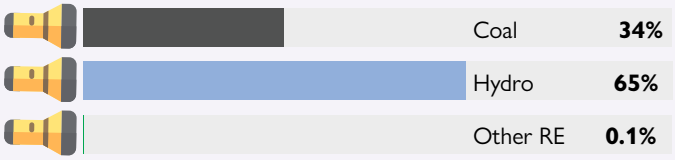
CAMBODIA
2017 Power Generation
6,633 Gwh



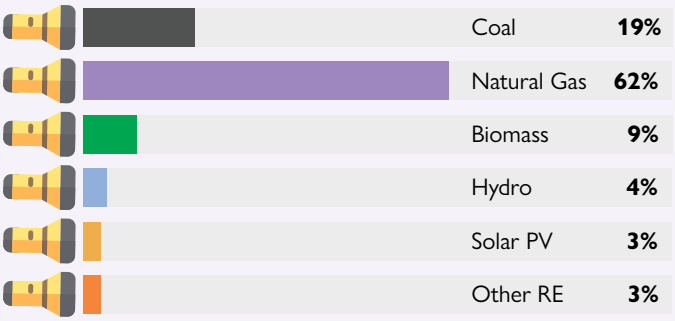
MYANMAR
2017 Power Generation
19,920 Gwh



LAO PDR
2017 Power Generation
31,740 Gwh



THAILAND
2018 Power Generation
187,362 Gwh



Data source: ASEAN-German Energy Programme (AGEP)

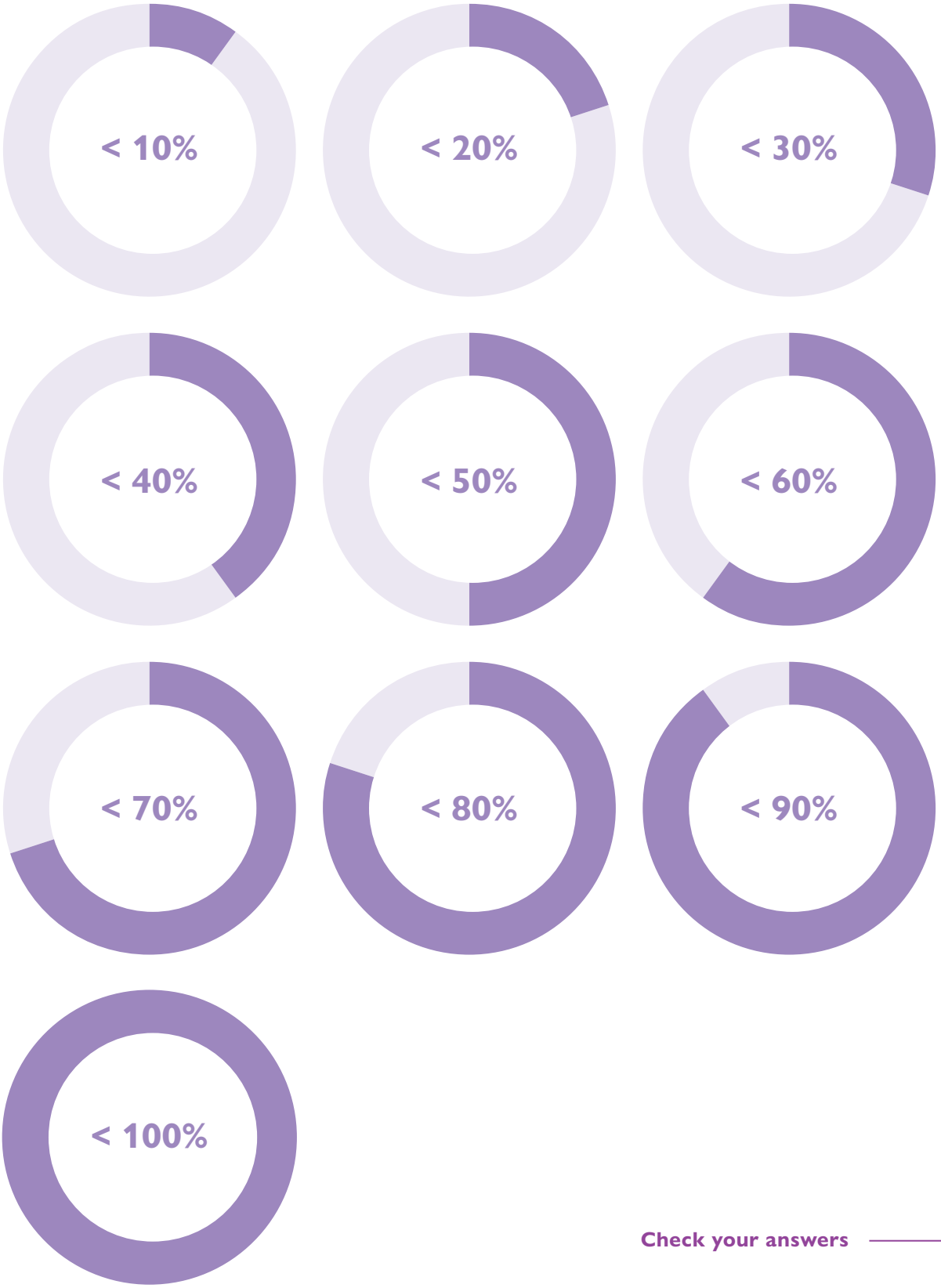
https://agep.aseanenergy.org/ SCAN ME

ENERGY QUIZ 2

ACCESS TO CLEAN COOKING

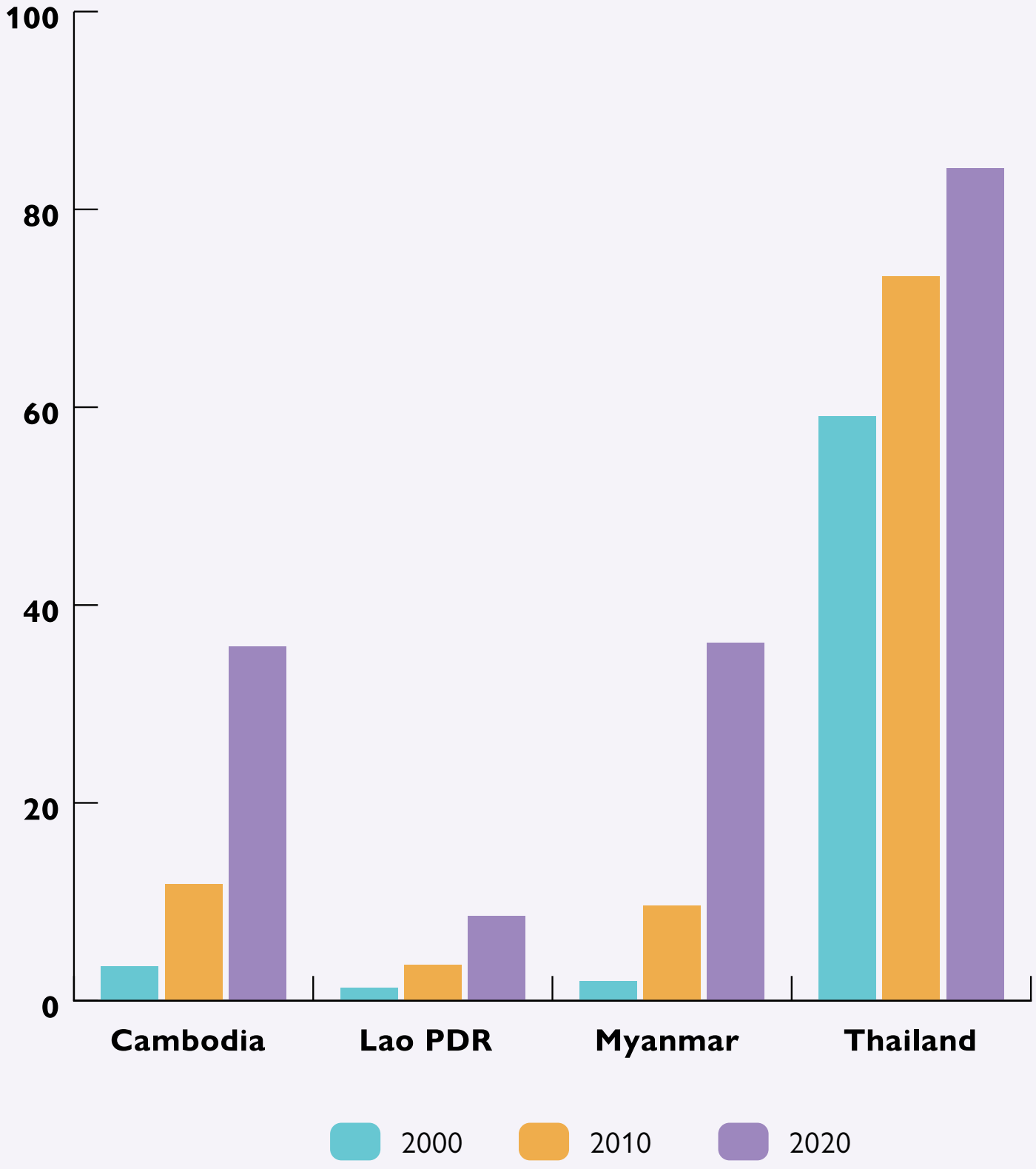
The share of the population in ASEAN that has access to clean cooking varies greatly between countries. According to the ASEAN Centre for Energy (ACE), as of 2017 around 60 million households or 240 million people, were still cooking with traditional biomass or non-modern fuels in ASEAN (ACE, 2020).

Task: Estimate percentage of population in your country with **access to clean cooking in 2020**.



Check your answers →

SHARE OF POPULATION WITH ACCESS TO CLEAN COOKING



Source: WHO (2022)

ENERGY QUIZ 3

ENERGY USAGE

Fill in the blank spaces!

The thick dust on a light bulb can block up to _____% of the light.

Each time we open our refrigerator, it lets up to _____% of cold air out.

Air conditioning, heating, and ventilating systems make up for _____% of the total energy use in the commercial sector.

When we turn an incandescent light bulb on, only _____% of the electricity used is turned into light while _____% of it is wasted as heat.

We can save up to _____% of energy when switching to a compact fluorescent as compared to a regular bulb. Another plus of a compact fluorescent is that it can last up to four years.

Check your answers →

ENERGY USAGE

Answers

The thick dust on a light bulb can block up to 50 % of the light.

Each time we open our refrigerator, it lets up to 30 % of cold air out.

Air conditioning, heating, and ventilating systems make up for 40-60 % of the total energy use in the commercial sector.

When we turn an incandescent light bulb on, only 10 % of the electricity used is turned into light while 90 % of it is wasted as heat.

We can save up to 75 % of energy when switching to a compact fluorescent as compared to a regular bulb. Another plus of a compact fluorescent is that it can last up to four years.

Data source: https://www.c-asean.org/post/fun-fact-about-energy

SCAN ME

1.3.2

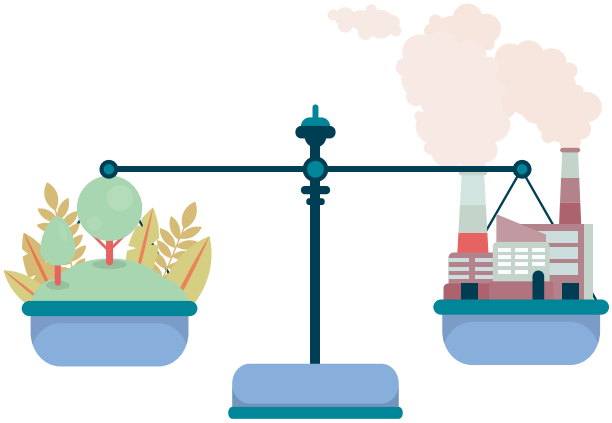
RENEWABLE ENERGY VS. NON-RENEWABLE ENERGY

Age Group: 15 years old and above

Time Required: 30-40 minutes for card game part and 2 - 3 hours for reflection questions research

Group Size: Recommended to do in pair or small group(s)

Location: It can be done anywhere. Indoor is preferable to prevent wind blowing all the cards away. It might be helpful to be somewhere with internet access to find the info you might need.



Materials:

1. Card decks 1, 2 and 3
2. Flipchart paper and a marker
3. Glue or adhesive tape
4. My Community's Energy Sources Worksheet

Learning Objectives:

By the end of this activity, participants will...

- ...be able to correctly identify the properties of the energy sources
- ...recognize the challenges of utilizing each source of energy, such as high initial costs, technical issues, and potential environmental impacts
- ...be able to critically evaluate the pros and cons of different energy sources and how can they apply that knowledge to their community context

Preparing materials: Print the 3 card decks provided and proceed to cut them out into individual pieces. Organize them in 3 decks according to the type and size of the cards.

CARD DECK 1

Energy Card

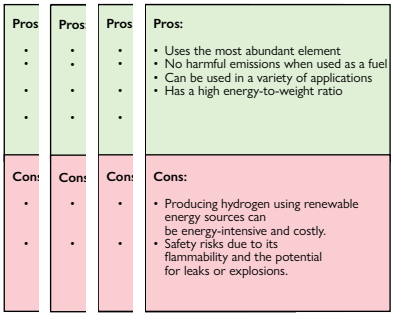
PLACE THE RIGHT SOURCE OF ENERGY IN THIS BLOCK	A type of energy that is generated by utilizing as a fuel source, typically through processes like fuel cells of combustion.
	Pros:
	Cons:

CARD DECK 2

Energy Source

CARD DECK 3

Pros & Cons



ACTIVITY INSTRUCTIONS

Step 1: Identify and match the energy source

- Spread all the energy cards (deck 1) on the table
- Read the description provided, one card at a time
- Based on the description, identify the "Energy Source" (deck 2 cards) that match with the description and place the identified Energy Source card on the first column on the energy card. Glue or tape them to the card.
- Repeat the same process and complete the matching of energy sources with their property descriptions.

Step 2: Matching Pros & Cons with each the energy source

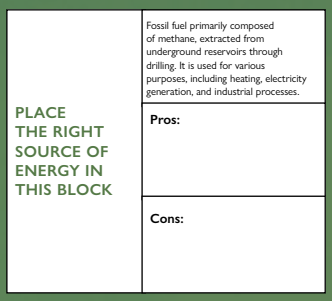
- Look at the Pros & Cons card (deck 3), one card at a time, and match each card with the Energy source. Glue or tape the Pros & Cons card on the Energy card. Repeat the same process until you match all the Pros & Cons cards to the Energy cards.

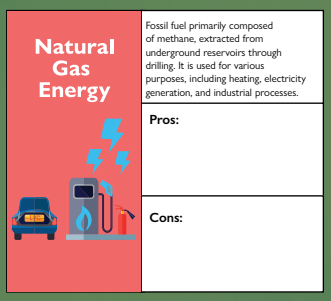
Step 3: Renewable Energy VS Non-Renewable Energy

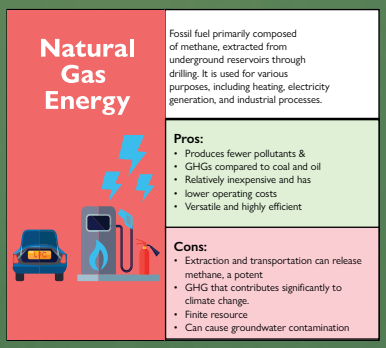
- Use a marker pen to divide a flipchart paper into 2 sections. Write "Renewable Energy" on the left side of the paper and write "Non-Renewable Energy" on the right side of the paper
- Look at all the Energy cards and identify which energy sources are renewable and which ones are non-renewable. Place each card on the corresponding side of the flipchart paper.

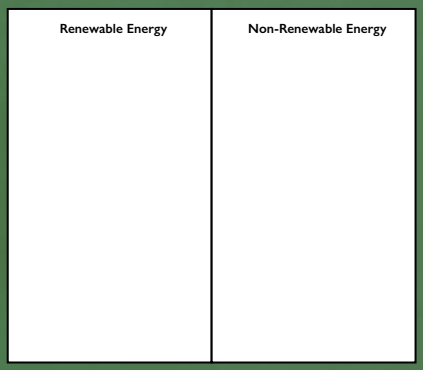
Step 4: Explore and reflect on the current and potential renewable energy sources in your community, along with related policies.

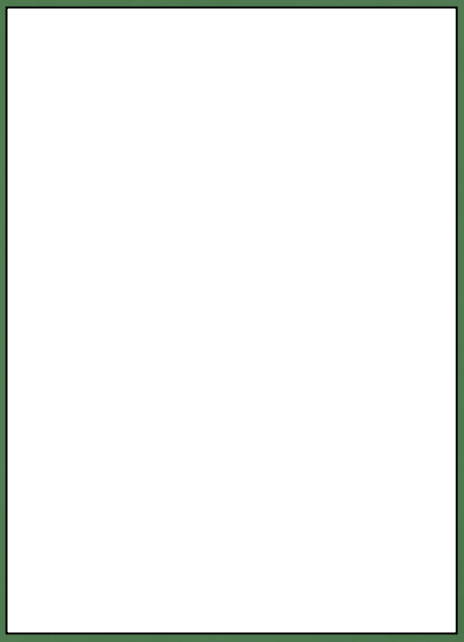
- Use the "My Community's Energy Sources Worksheet" with the guiding questions to explore and reflect on the current and potential renewable energy sources in your community, as well as the related policies.





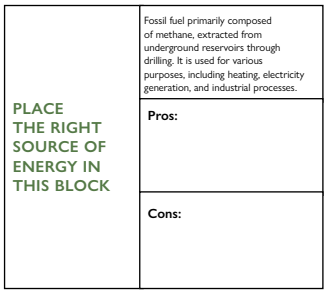






CARD DECK 1 ENERGY CARD

Instructions:
Print this page on one-sided paper (A4) and cut it into individual pieces. See picture below.



PLACE THE RIGHT SOURCE OF ENERGY IN THIS BLOCK	Fossil fuel primarily composed of methane, extracted from underground reservoirs through drilling. It is used for various purposes, including heating, electricity generation, and industrial processes
	Pros:
	Cons:

PLACE THE RIGHT SOURCE OF ENERGY IN THIS BLOCK	A type of energy that is generated by utilizing hydrogen as a fuel source, typically through processes like fuel cells or combustion
	Pros:
	Cons:

PLACE THE RIGHT SOURCE OF ENERGY IN THIS BLOCK	Used to generate energy by burning liquid petroleum products for various applications, including heating buildings, generating electricity, and powering vehicles
	Pros:
	Cons:

PLACE THE RIGHT SOURCE OF ENERGY IN THIS BLOCK	Harnessing the kinetic energy of ocean tides as they rise and fall to turn turbines placed underwater to generate power
	Pros:
	Cons:

PLACE THE RIGHT SOURCE OF ENERGY IN THIS BLOCK	Energy comes from Uranium which is mined underground. It generates electricity by splitting atoms, releasing heat to produce steam that drives turbines to generate electricity.
	Pros:
	Cons:

PLACE THE RIGHT SOURCE OF ENERGY IN THIS BLOCK	Energy that is produced by burning of the black materials mined from deep underground to generate heat, which is then used to produce electricity.
	Pros:
	Cons:

PLACE THE RIGHT SOURCE OF ENERGY IN THIS BLOCK	Energy that is produced by burning organic materials like wood, crops, and waste to generate heat and electricity.
	Pros:
	Cons:

PLACE THE RIGHT SOURCE OF ENERGY IN THIS BLOCK	Conversion of kinetic energy of wind into electrical power
	Pros:
	Cons:

PLACE THE RIGHT SOURCE OF ENERGY IN THIS BLOCK	Generating electricity & heat by using the natural heat from inside the Earth
	Pros:
	Cons:

PLACE THE RIGHT SOURCE OF ENERGY IN THIS BLOCK	Conversion of energy from sunlight into electricity
	Pros:
	Cons:

PLACE THE RIGHT SOURCE OF ENERGY IN THIS BLOCK	Harnessing the energy of flowing or falling water
	Pros:
	Cons:

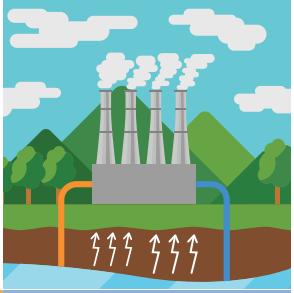
CARD DECK 2

ENERGY SOURCE CARD

Instructions:
Print this page on one-sided paper (A4) and cut it into individual pieces.

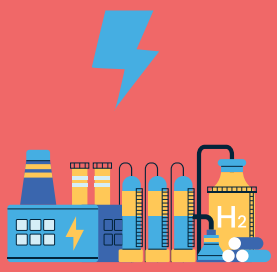
Stack them all into one pile.

Geothermal Energy

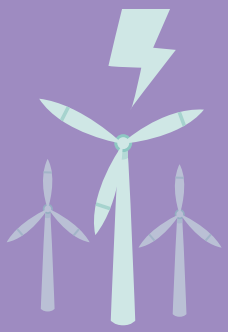


Biomass Energy

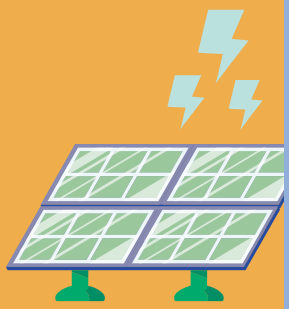
Hydrogen Energy



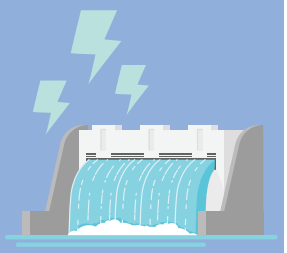
Wind Energy



Solar Energy



Hydro Energy

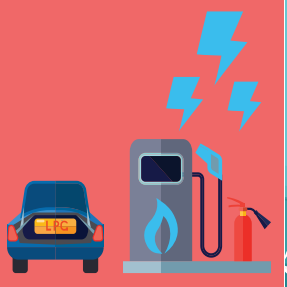


Nuclear Energy

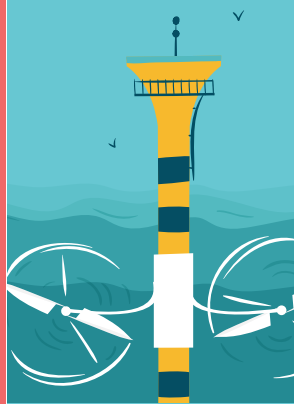
Crude Oil Energy

Coal Energy

Natural Gas Energy



Tidal Energy



CARD DECK 3 ENERGY SOURCE PROS & CONS

Instructions:
Print this page on a paper (A4) and cut it into individual pieces
(Pros & Cons together = 1 piece)

Stack them all together into one pile.

Pros:
- Harnesses heat from within the Earth, making it a virtually inexhaustible energy source
- Reliable and consistent energy production

Cons:
- Dependent of geological conditions
- Make significant environmental impacts from drilling

Pros:
- Uses the most abundant element
- No harmful emissions when used as a fuel
- Can be used in a variety of applications
- Has a high energy-to-weight ratio

Cons:
- Producing hydrogen using renewable energy sources can be energy-intensive and costly
- Safety risks due to its flammability and the potential for leaks or explosions.

Pros:
- Utilizing the abundant resource
- Cheap when produced in scale
- Minimal GHGs release once the equipment is installed.
- Occupy minimal land area, allowing land beneath them to be used for other purposes

Cons:
- Unreliable production - dependent of wind speed and direction
- Local people often dislike the noise of the turbines

Pros:
- Minimal environmental impact
- Low maintenance & long lifespan
- Has been used widely
- Scalability - can be scaled up or down to meet different energy needs, from small residential to large scale

Cons:
- Initial high installation costs
- Energy production depending on weather and time of day
- Requires ample space for installation
- Storage can be expensive

Pros:
- Extremely reliable
- High energy density, making it a highly efficient source of energy
- Can produce large amounts of electricity
- Low GHGs emission

Cons:
- Has radioactive waste that requires long-term storage & management, posing environmental & safety concerns
- High upfront costs
- Uranium, the primary fuel is finite

Pros:
- Cheap energy
- Quite reliable production
- Low carbon emission once the equipment is installed.

Cons:
- Unreliable production
- Installation of equipment can have a significant environmental impacts on coastline & marine ecosystems

Pros:
- Cheap when produced in scale
- Low carbon emission once the equipment is installed.

Cons:
- Expensive to build
- Large local impacts, sometimes causing the community relocation.
- Disrupts freshwater ecosystems

Pros:
- Reduce organic materials in landfill
- Reduces waste and greenhouse gas emissions

Cons:
- Can compete with food production
- Possibly causing deforestation for more farming area
- Transportation & storage issues
- Fluctuating availability & supply

Pros:
- Relatively affordable energy
- Reliable production of energy
- Widely available fossil fuel found around the world and existing infrastructure are designed to use this energy source

Cons:
- Releases pollutants contributing to air pollution and negative health impacts
- Significant contributor to global greenhouse gas emissions and climate change

Pros:
- Extensive infrastructure for extraction, refining, and distribution exists, facilitating its use and availability
- High energy density and versatile, supporting diverse industries

Cons:
- Releases pollutants and particulate matter, contributing to air pollution & climate change
- Extraction and transportation can lead to habitat destruction, posing severe environmental risks

Pros:
- Produces fewer pollutants & GHGs compared to coal and oil
- Relatively inexpensive and has lower operating costs
- Versatile and highly efficient

Cons:
- Extraction and transportation can release methane, a potent GHG that contributes significantly to climate change
- Finite resource
- Can cause groundwater contamination

MY COMMUNITY'S
ENERGY SOURCES WORKSHEET

Objective: Explore, research and reflect on the current and potential renewable energy sources in your community, along with related policies

Instructions: Look at your community and consider the following questions

Looking for more information? Visit Chapter 1 for additional resources

1. **Current Power Source:** What is the current power source for the electricity generation in your city / community?

2. **Renewable Energy Potential:** What is the most appropriate renewable energy source for electricity in your city or community in 10-15 years? Explain your answer here.

PLACE YOUR RENEWABLE ENERGY CARD HERE

3. **Supporting Policies:** Is there currently any policy in your country that supports this type of renewable energy source? Find the name of the law and/or article that supports renewable energy in your country.

ANSWER KEY 1

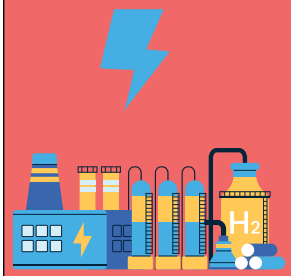
Natural Gas Energy

Fossil fuel primarily composed of methane, extracted from underground reservoirs through drilling. It is used for various purposes, including heating, electricity generation, and industrial processes

Pros:
- Produces fewer pollutants & GHGs compared to coal and oil
- Relatively inexpensive and has lower operating costs
- Versatile and highly efficient

Cons:
- Extraction and transportation can release methane, a potent GHG that contributes significantly to climate change
- Finite resource
- Can cause groundwater contamination

Hydrogen Energy



A type of energy that is generated by utilizing hydrogen as a fuel source, typically through processes like fuel cells or combustion

Pros:
- Uses the most abundant element
- No harmful emissions when used as a fuel
- Can be used in a variety of applications
- Has a high energy-to-weight ratio

Cons:
- Producing hydrogen using renewable energy sources can be energy-intensive and costly
- Safety risks due to its flammability and the potential for leaks or explosions.

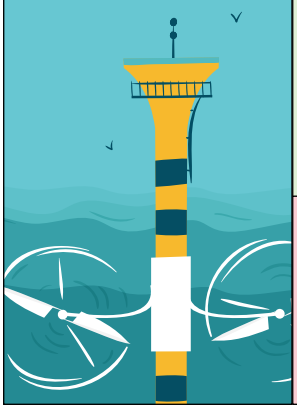
Crude Oil Energy

Used to generate energy by burning liquid petroleum products for various applications, including heating buildings, generating electricity, and powering vehicles

Pros:
- Extremely reliable
- High energy density, making it a highly efficient source of energy
- Can produce large amounts of electricity
- Low GHGs emission

Cons:
- Has radioactive waste that requires long-term storage & management, posing environmental & safety concerns
- High upfront costs
- Uranium, the primary fuel is finite

Tidal Energy



Harnessing the kinetic energy of ocean tides as they rise and fall to turn turbines placed underwater to generate power

Pros:
- Cheap energy
- Quite reliable production
- Low carbon emission once the equipment is installed.

Cons:
- Unreliable production
- Installation of equipment can have a significant environmental impacts on coastline & marine ecosystems

Nuclear Energy

Energy comes from Uranium which is mined underground. It generates electricity by splitting atoms, releasing heat to produce steam that drives turbines to generate electricity.

Pros:
- Extensive infrastructure for extraction, refining, and distribution exists, facilitating its use and availability
- High energy density and versatile, supporting diverse industries

Cons:
- Releases pollutants and particulate matter, contributing to air pollution & climate change
- Extraction and transportation can lead to habitat destruction, posing severe environmental risks

Coal Energy

Energy that is produced by burning of the black materials mined from deep underground to generate heat, which is then used to produce electricity.

Pros:
- Relatively affordable energy
- Reliable production of energy
- Widely available fossil fuel found around the world and existing infrastructure are designed to use this energy source

Cons:
- Releases pollutants contributing to air pollution and negative health impacts
- Significant contributor to global greenhouse gas emissions and climate change

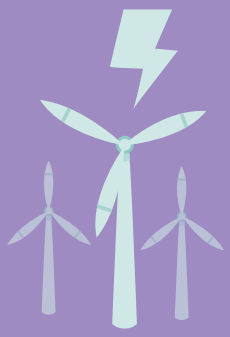
Biomass Energy

Energy that is produced by burning organic materials like wood, crops, and waste to generate heat and electricity.

Pros:
- Reduce organic materials in landfill
- Reduces waste and greenhouse gas emissions

Cons:
- Can compete with food production
- Possibly causing deforestation for more farming area
- Transportation & storage issues
- Fluctuating availability & supply

Wind Energy

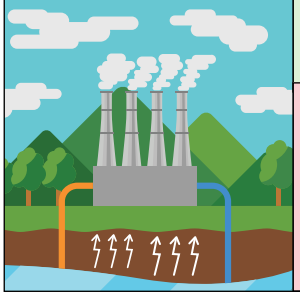


Conversion of kinetic energy of wind into electrical power

Pros:
- Utilizing the abundant resource
- Cheap when produced in scale
- Minimal GHGs release once the equipment is installed.
- Occupy minimal land area, allowing land beneath them to be used for other purposes

Cons:
- Unreliable production - dependent of wind speed and direction
- Local people often dislike the noise of the turbines

Geothermal Energy

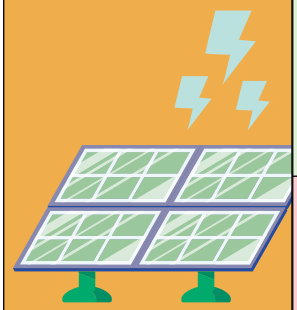


Generating electricity & heat by using the natural heat from inside the Earth

Pros:
- Harnesses heat from within the Earth, making it a virtually inexhaustible energy source
- Reliable and consistent energy production

Cons:
- Dependent of geological conditions
- Make significant environmental impacts from drilling

Solar Energy

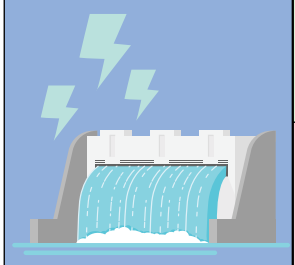


Conversion of energy from sunlight into electricity

Pros:
- Minimal environmental impact
- Low maintenance & long lifespan
- Has been used widely
- Scalability - can be scaled up or down to meet different energy needs, from small residential to large scale

Cons:
- Initial high installation costs
- Energy production depending on weather and time of day
- Requires ample space for installation
- Storage can be expensive

Hydro Energy



Harnessing the energy of flowing or falling water

Pros:
- Cheap when produced in scale
- Low carbon emission once the equipment is installed.

Cons:
- Expensive to build
- Large local impacts, sometimes causing the community relocation.
- Disrupts freshwater ecosystems

ANSWER KEY 2

Renewable Energy	Non-Renewable Energy
Solar	Crude Oil
Hydrogen	Coal
Hydro	Natural Gas
Wind	Nuclear
Tidal	
Biomass	

Note: Many people mistakenly consider nuclear energy a renewable source; however, it is not classified as renewable because the uranium used in the process is finite.

Uranium, the primary fuel for nuclear reactors, is a naturally occurring element found in limited quantities in the Earth's crust. While there are substantial reserves of uranium worldwide, they are not inexhaustible. The process of extracting, refining, and enriching uranium also has environmental impacts and energy requirements.

Due to the finite nature of uranium reserves and the challenges associated with nuclear waste disposal, nuclear energy is not considered a renewable energy source. Instead, it is classified as a low-carbon but non-renewable energy option.

1.3.3

RENEWABLE ENERGY ALTERNATIVES

Renewable energy is energy from a source that can be maintained in a constant supply over time. Six main renewable energy sources exist: water, sun, wind, biomass, energy from within the earth, and hydrogen power. Since the beginning of time, these renewable energy sources have provided warmth, movement, light; in short, energy for life. From early sailing ships to high production wind farms; from ancient civilizations to future generations, solar, wind, water and biomass have been primary sources of power for our everyday needs. With a growing concern on climate change and the shortage of fossil-fuel based energy and advancements in technology, the integration of renewable energy poses real opportunities and real challenges for today and for our future.

Age Group: 15 years old and above

Time Required: 2-3 hours

Group Size: This activity can be done individually or as a small group

Materials:

1. Renewable Energy Research Template
2. Phone or computer with access to the Internet

Activity Objectives / Participants will...

- Increase awareness and understanding of diverse renewable energy options and their role in sustainable development.
- Be able to compare and contrast different renewable energy sources and their potential impact on your community.
- Assess the potential suitability of different renewable energy sources for your community, considering local needs and conditions.

YOUR ASSIGNMENT

- Search the daily news or articles for instances of diverse renewable energy forms being utilized in your country. Once you locate the articles, thoroughly read them, and extract relevant information to address the questions pertaining to each renewable energy source.
- Feel free to select a few sources of energy that have the potential to be appropriate for your community. You do not have to research all sources of energy.
- Use the research template with questions provided in this document for your research.

A. Bioenergy/Biomass

Biomass is matter usually thought of as garbage. Some of it is just stuff lying around, like dead trees, tree branches, yard clippings, left-over crops, wood chips & bark and sawdust from lumber mills. It can even include used tires and livestock manure.

From the news story, how is this kind of energy used in your country currently?

_____

_____

Where is it being utilized here in your country?

_____

_____

What are the challenges to its use by most of the people in your country?

What are the pros (advantages) and cons (disadvantages) of using this form of energy here in your country?

Do you know of any use of bioenergy/biomass in your area? If so, explain.

List your information sources: (i.e. news channel, magazine, field guide, textbook, other book, brochure, television, radio, Internet, talking with a person, etc.)

B. Earth Energy

Geothermal Energy has been around for as long as the Earth has existed. "Geo" means earth, and "thermal" means heat, so geothermal means earth-heat. The different ways of obtaining it are through a Horizontal ground loop, a Coiled loop, a Vertical ground loop, Lake loop systems, or an Open loop.

From the news story, how is this kind of energy used in your country currently?

Where is it being utilized here in your country?

What are the challenges to its use by most of the people in your country?

What are the pros (advantages) and cons (disadvantages) of using this form of energy here in your country?

Do you know of any use of earth energy source in your own area? If so, explain.

List your information sources: (i.e. news channel, magazine, field guide, textbook, other book, brochure, television, radio, Internet, talking with a person, etc.)

C. Hydroelectric Energy

Hydroelectric power uses the kinetic energy of moving water to make electricity.

From the news story, how is this kind of energy used in your country currently?

Where is it being utilized here in your country?

What are the challenges to its use by most of the people in your country?

What are the pros (advantages) and cons (disadvantages) of using this form of energy here in your country?

Do you know of any use of hydroelectric energy source in your own area? If so, explain.

List your information sources: (i.e. news channel, magazine, field guide, textbook, other book, brochure, television, radio, Internet, talking with a person, etc.)

D. Solar Energy

Solar energy is a way of saying "energy that comes from the sun". Today, many buildings, organizations, schools, and even whole communities in GMS are powering themselves using the sun's energy.

From the news story, how is this kind of energy used in your country currently?

Where is it being utilized here in your country?

What are the challenges to its use by most of the people in your country?

What are the pros (advantages) and cons (disadvantages) of using this form of energy here in your country?

Do you know of any use of solar energy source in your own area? If so, explain.

List your information sources: (i.e. news channel, magazine, field guide, textbook, other book, brochure, television, radio, Internet, talking with a person, etc.)

E. Wind energy

Wind energy harnesses the kinetic energy of the wind and converts it into mechanical or electrical energy. This renewable energy source is becoming increasingly important in the GMS. When wind turbines capture wind energy, they convert it into electricity, providing a clean alternative to fossil fuels. In addition to generating electricity, wind energy has traditionally been used for various purposes, such as propelling boats with sails and pumping water from wells using windmills.

From the news story, how is this kind of energy used in your country currently?

Where is it being utilized here in your country?

What are the challenges to its use by most of the people in your country?

What are the pros (advantages) and cons (disadvantages) of using this form of energy here in your country?

Do you know of any use of wind energy in your own area? If so, explain.

List your information sources: (i.e. news channel, magazine, field guide, textbook, other book, brochure, television, radio, Internet, talking with a person, etc.)

F. Hydrogen energy

Hydrogen energy involves using hydrogen as a clean and versatile source of energy. It can be produced through methods like electrolysis, steam methane reforming, or thermochemical processes.

From the news story, how is this kind of energy used in your country currently?

Where is it being utilized here in your country?

What are the challenges to its use by most of the people in your country?

What are the pros (advantages) and cons (disadvantages) of using this form of energy here in your country?

Do you know of any use of hydrogen energy source in your own area? If so, explain.

List your information sources: (i.e. news channel, magazine, field guide, textbook, other book, brochure, television, radio, Internet, talking with a person, etc.)

My Thoughts and Feelings After Completing This Assignment:

1.4.1

WHAT AM I DRINKING, WHAT ARE THE IMPACTS, AND WHAT CHANGE CAN I MAKE OR INFLUENCE?

Problem solving (or problem influencing) is not just about having a fuller picture of the issues and challenges that define sustainability in the Mekong region's environment, societies and economies. It is also about using the insights that you get and deciding on what you can do to contribute with positive actions and outcomes that will add to the necessary systemic solutions. You can add a dimension of decision-making and action by asking the following questions:

- What impact does this have?
- Does this need to change?
- How can things be changed?

Age Group: 15 years old and above

Time Required: 90-120 minutes

Group Size: This activity can be done individually or as a small group

Materials:

- Flipchart or other large sheet of paper
- Permanent markers and pens
- Note cards or sticky notes.
- Worksheets (Task 1, 2 and 3)

Activity Objectives / Participants will...

The purpose of this activity is to provide deep insights into the environmental, social and economic impacts of a personal activity, as well as an understanding of what one can do to bring or influence positive change.

TASK 1: Take some time to investigate some or all of the following questions. Use the table with guiding questions provided on the next page to record your answers.

- Does my daily cup of tea, coffee or other drinks have an impact on any, or all, of the three thematic issues that we are focused on: 1) Sustainable Freshwater Ecosystems; 2) Energy Use, and 3) Climate Change
- Where does the energy come from to make my drink? Is it from a renewable or non-renewable source?
- Where does the water that is used in my drink come from? Where is its source?
- Where do the drink's ingredients come from? Are they locally grown or imported from outside my country or even the Mekong region?
- Is the drink that I mostly drink organic or non-organic?
- Are the cups that I mostly use disposable ones, or are they reusable?
- Where do the sugar, milk or creamer that I use in my drink come from?
- What happens to the coffee grounds / tea leaves, cups and other items used to make and drink my drink when it is finished? Where do they go?

TASK 2: Take some time to investigate the possible impacts that your daily cup of drink has...

...on the natural freshwater ecosystem environment in my country, and regionally.
...on energy production and use in my country, and regionally.
...on global climate change and its effects in my country, and regionally.
...on economic and social development in my country, and in the region.

and what can be done to reduce the negative impacts and increase the positive impacts.

Note: Look at the likely impacts you have identified, and check that you have covered all of the following:

- Local/global impacts
- Impacts in relation to coffee/tea and other drinks' ingredients growing, processing (eg. making instant coffee granules), transport, brewing, packaging and waste management
- Positive and negative impacts

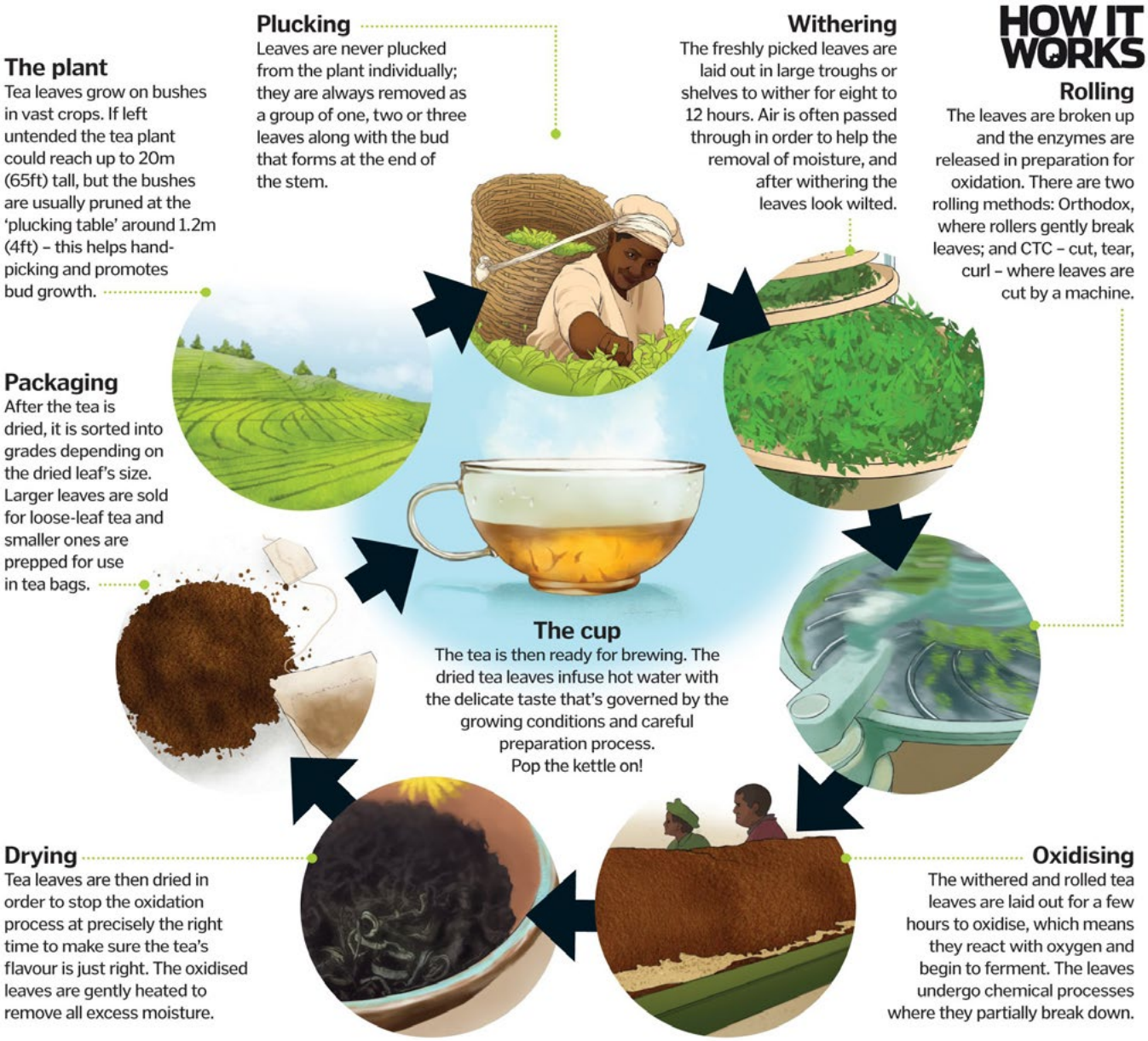
Additional resources to support your thinking process when completing Tasks 1 & 2.

Source: How coffee is made?

Here's how your cup of coffee contributes to climate change:
https://theconversation.com/heres-how-your-cup-of-coffee-contributes-to-climate-change-196648

Wonder about the impact of your daily cup of coffee on the planet? Here's the bitter truth:
https://ideas.ted.com/truth-about-coffee-impact-on-environment-planet/

Coffee: here's the carbon cost of your daily cup – and how to make it climate-friendly:
https://theconversation.com/coffee-heres-the-carbon-cost-of-your-daily-cup-and-how-to-make-it-climate-friendly-152629



Source: How tea is made?

From Farm To Cup: The Environmental Impact of Tea:
https://www.thegoodboutique.com/inspiration/environmental-impact-of-tea

The Environmental Impact of Tea Production:
https://www.halmaritea.com/blog/environmental-impact-tea-production

The Carbon Footprint of a Cup of Tea:
https://circularecology.com/news/the-carbon-footprint-of-a-cup-of-tea

TEST 1 WHAT AM I DRINKING AND WHAT ARE THE IMPACTS ON THE ENVIRONMENT?

Instructions: Brainstorm answers (individually or as a group) to each of these questions in the table. Don't worry if you are having to make assumptions—jot down what you think are the most likely answers—no one will be holding you to the accuracy of your answers.

Note: You can print this table on an A0 size paper or redraw freehand the table onto a flipchart paper or other large sheet of paper, and use note cards or sticky notes to record your answers.

Insight Questions	Your answers
Where does the energy come from to make my drink? Is it from a renewable or non-renewable source?	
Where does the water that is used in my drink come from? Where is its source?	
Where does the drink's ingredients come from? Is it locally grown or imported from outside my country or even the Mekong region?	
Is the drink that I mostly drink organic or non-organic?	
Are the cups that I mostly use for my drink disposable ones or are they reusable?	
Where does the sugar, milk or creamer that I use in my drink come from?	
What happens to the coffee grounds / tea leaves, cups and other items used to make and drink my coffee when it is finished? Where do they go?	

TEST 2 WHAT AM I DRINKING AND WHAT ARE THE IMPACTS ON THE ENVIRONMENT?

Instructions: Individually or as a group, use the questions in the table below to identity the real and/or possible impacts that your daily cup of coffee or tea has on the three thematic areas within the Mekong Region: 1) Sustainable Freshwater Ecosystems; 2) Energy Use, 3) Climate Change and what can be done to reduce the negative impacts and increase positive impacts.

Look at the likely impacts you have identified, and check that you have covered all of the following:

- Local/global impacts
- Impacts in relation to coffee/tea growing, processing (e.g. making instant coffee granules), transport, coffee/tea making (ie making the cup of coffee/tea you drink), waste management
- Negative and positive impacts on the environment, society and economy

Impact Questions	**Negative Impacts** (local / global)	**Positive Impacts** (local / global)
What impact does my daily cup of coffee or tea have on the natural freshwater ecosystem environment in my country, and regionally?		
What impact does my daily cup of coffee or tea have on energy production and use in my country, and regionally?		
What impact does my daily cup of coffee or tea have on global climate change and its effects in my country, and regionally?		
What impact does my daily cup of coffee or tea have on economic and social development in my country, and in the region?		

TASK 3: What Change Can I Make or Influence?

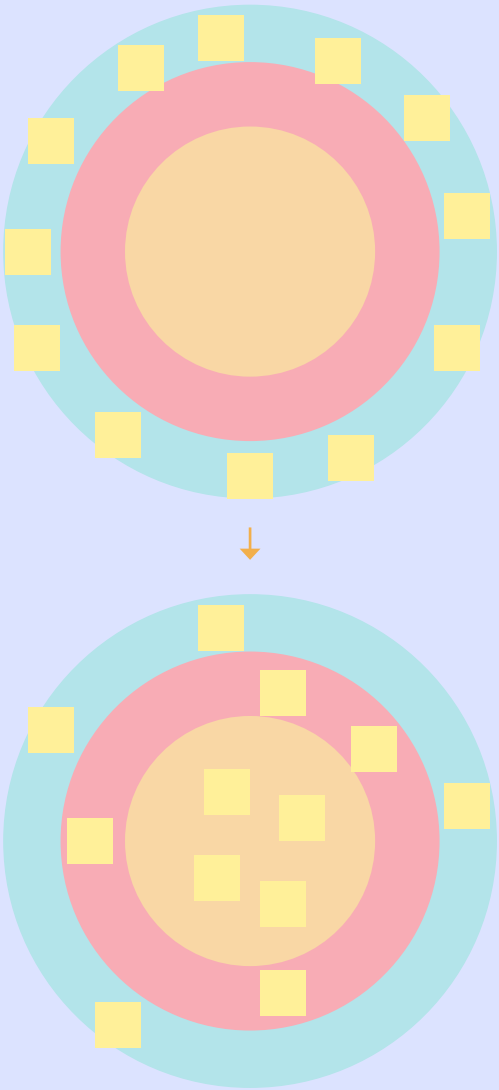
Instructions:

1. Take a large sheet of paper (a flipchart for example) and draw three concentric circles on it, making each large enough to fit in several sticky notes or similar slips of paper.
    - **Inner Circle** = Individual action that can influence
    - **Middle Circle** = School/university/organization actions to influence
    - **Outer Circle** = Outside of the power to influence by myself, my peers, and my school

2. Brainstorm what decision / actions could be taken to make your drink...
    - ...more environmentally sustainable in relation to freshwater ecosystems?
    - ...more environmentally sustainable in relation to energy production and consumption?
    - ...more environmentally sustainable in relation to climate change (mitigation of greenhouse gases and resiliency to climate change impacts)

3. Think of multiple things that could be done, and do not limit yourself to only one or two ideas. Be as imaginative as you can. For this activity your suggestions don't need to be totally economically, socially and politically feasible yet in relation to the global or national context of your own country.

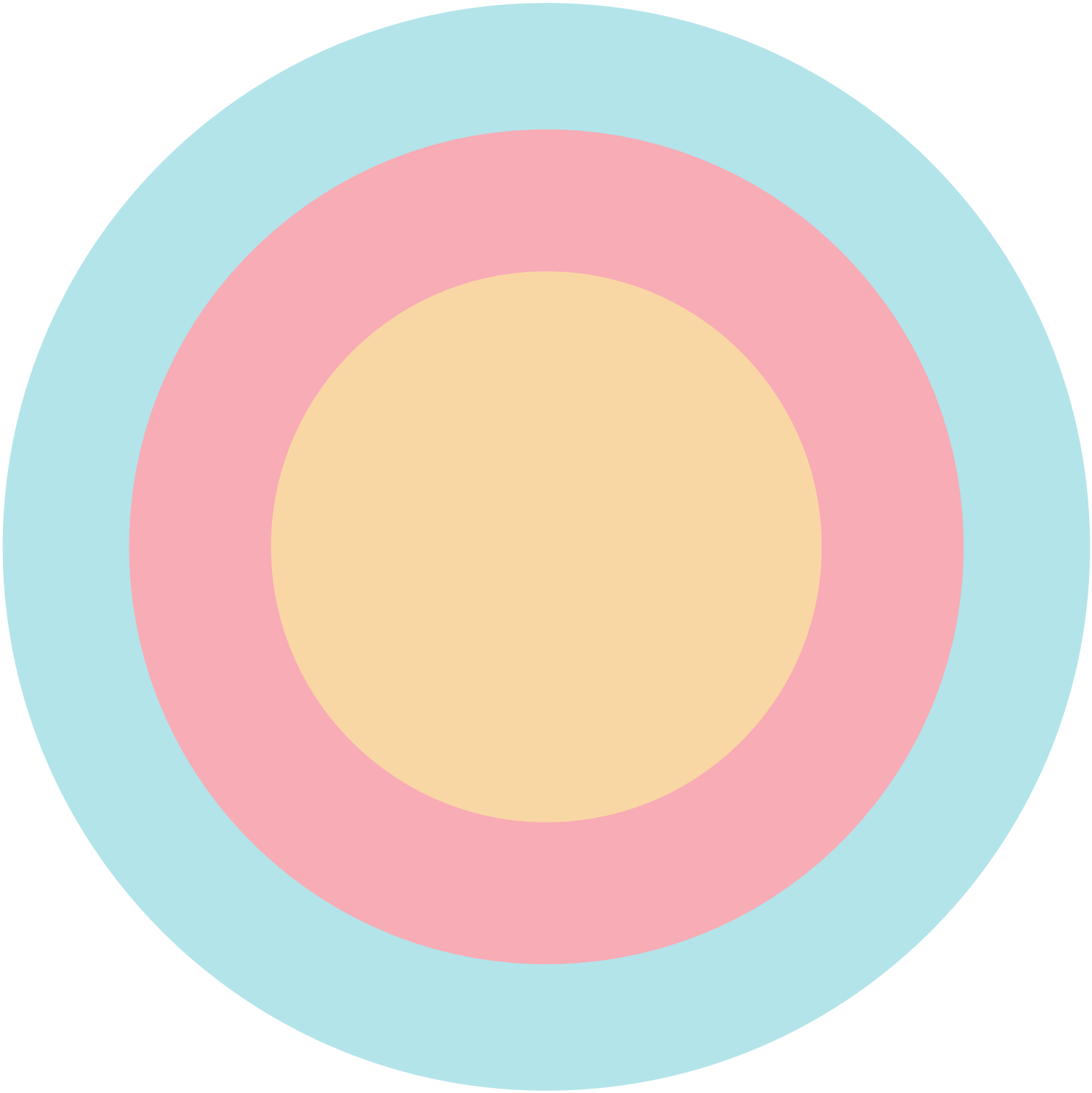
4. Write each suggestion on an individual sticky note, then...
    - Put all the notes on the outer circle of the paper, similar to this example.



5. Now begin to sort the points you have identified.
    - Which of them are feasible and could be undertaken by your school/college/organization (including things that the school/college/organization could do to influence others)?
        - Move these into the second circle
    - Keep any ideas that are either not feasible or outside the power of the school/college/organization in the outer circle.
    - Next, which of the ideas could you, as an individual, undertake (including those that you can influence your school/college/organization and peers to do something about)?
        - Move these into the inner circle and leave any that are outside your own power in the second circle.

TEST 3

WHAT CHANGE CAN I MAKE OR INFLUENCE?
ACTION INFLUENCE CIRCLE



Inner Circle = Individual action that can influence

Middle Circle = School/university / organization actions to influence

Outer Circle = Outside of the power to influence by myself, my peers, and my school

1.4.2

PIECES, PATTERNS AND PROCESSES

Age Group: 15 years old and above
(activities and depth can be adapted to age)

Group Size: Small team(s) of 3-9 people

Time Required:

- 30 minutes to 1 hour for introduction
- 2-5 hours for community investigation and data collection
- 1-2 hours for analysis
- 30 min to 1 hour for discussion and debrief

Materials:

- Field Notebook or Journals
- Binoculars (optional)
- Bird I.D. books or laminated sheets; Bird cutouts (optional)
- Macro-invertebrate sampling equipment (optional)
- Plant guide (e.g. wetland plant I.D. field guide) (optional)
- Pre-drawn large map of the investigation area (e.g. wetland and community)

Author/Source: Magic Eyes Chao Phraya Barge Program (ME-CPBP)

Activity Description
Pieces, Patterns and Processes is a learner-directed community investigation activity whereby youth, in teams, develop their own investigative questions based on some background knowledge, as well as their own interests, within three areas: Environment, Economy and Society/Culture. Participants then go into the community to investigate and try to find the answers to their questions using observation, interviewing, map making and, if possible, hands-on experience in the process. This activity gives youth the opportunity to discover things about the lives and livelihood of their community, its people and their relationship to their environment. The primary objective of this activity is to have youth discover the connections and relationships that exist between the three sectors mentioned above and then examine their own lives and communities within this context.

Materials:

- Understand how to conduct a community investigation outside of the classroom as part of a field research team.
- Develop skills in observation, questioning, interviewing, field data collection, critical thinking, analysis and synthesis, systems thinking and map-making.
- Gain a greater understanding of the interdependent relationships that exist in any community between the environment, economy and society/culture.

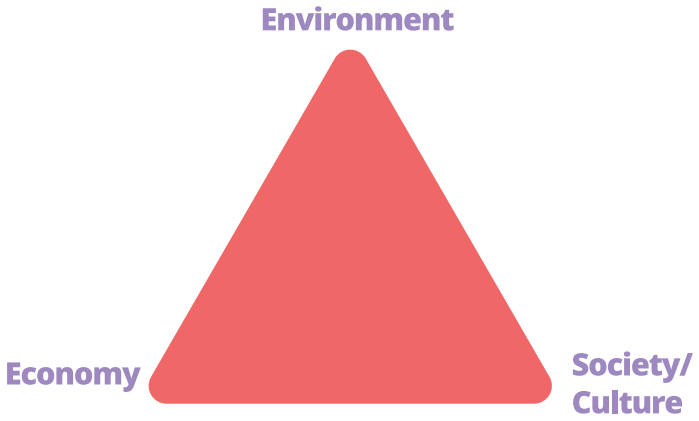
BACKGROUND INFORMATION

Pieces, Patterns and Processes (PPP) is adapted from the various needs assessment techniques (PRA, RRA and other similar approaches) used by NGOs and others to learn more about a particular place in a way that directly involves the local community development stakeholders. PPP asks participants to develop preliminary questions that will enable them to more effectively go into a community to collect information (the pieces) through a variety of methods, including: observation, interviewing, mapping, etc. The pieces of information will at times seem quite isolated in nature, but as more pieces are collected, trends and patterns that illustrate the connections, linkages and relationships that are inherent within the community relating to environment, economy and society/culture should start to become obvious.

Activity Outline

1 Review some background information on the ecosystem area and/or community that you will be investigating, incorporating as much info as possible about the history, culture and other aspects that will help you form your own more penetrating questions. If you have a map of the community, sometimes this helps to visualize some of the issues that you may want to ask questions about and investigate more closely.

2 Go into the natural environment and community, then investigate it from three different angles: Environment, Economy and Society/Culture (the PPP triangle). If you are unclear about what the three different angles mean, brainstorm the meaning of each angle with your friends. The buzzwords that you come up with will provide a good basis for you to develop investigative questions.



3 If you work with your team, first divide your team into three expert groups to form your own discovery questions. Sit together and discuss what you want to find out as well as come up with 5–10 questions that will focus your investigation. Sometimes one person in your group is needed to help facilitate the group's discussion flow and question formulation. Start with easy questions that begin with "what" then add some "how" and "why" questions. Each group must also agree on a symbol for each of the common features you think that you will encounter in the community to go on the map (e.g. the economy group may want to draw a small bag or soda bottle to represent a shop selling goods).

4 After each "expert" group has agreed on the investigative questions...
Optional: divide the expert group members into 2-3 new groups so that each new group has 1-3 representatives from each of the "expert" groups.

- Go into the natural environment/community, seeking the answers to your self-generated questions, while mapping the features that you see that relate to your focus. Time should be given to stop and interview local people (interviewing people of different ages, genders, types of work, etc. is preferred to just talking to several people with similar characteristics).
- At times there may be opportunities for you or your team to have hands-on experiences in the community (e.g. join in making pottery, planting rice, making mud bricks, etc.) while carrying out your PPP activities.

5 Once your team returns from the community, you should meet back together to discuss what you found and organize your information. Place the large master map on the floor. Write Environment, Economy, Society/ Culture on the paper around the map. Leave space for you to write down the facts. Create the map and record your observations with a legend with all the symbols, and you may write 3-4 additional facts (pieces) that you discovered while in the community.

6 After the map is complete, all the teams sit together around the map. Each one will make a short presentation of what they found out. The team members should encourage each other to listen and ask questions after each presentation. The connections and linkages that exist between the three sectors (Environment, Economy, Society/Culture) should be discussed. Additional questions about the meaning, causes, consequences, processes occurring, etc. should be raised.

7 Finally, you should prioritise your stakeholders, in order to focus on who you should be concentrating your time, attention and how to develop your advocacy message that reflects your stakeholders concerns.

WORKSHEET

1 **Identify the map symbols:** With your team, imaging yourself walking in to a community, what are some common features you will encounter? Brainstorm and agree on a symbol for each of the common features to go on the map.

Symbol	Representation of...

2 **Develop investigation questions:** Sit together with your team and discuss what you want to find out while going into the community. Come up with 5–10 questions that help you to focus your investigation.

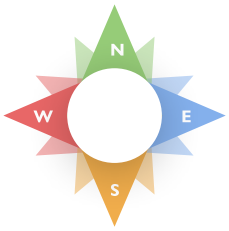
What You Want to Find Out	What Questions We Should Ask	What We Should Observe

INTERVIEW NOTE PAGE

COMMUNITY MAP

1.4.3

MAPPING A THEMATIC ISSUE WITH THE COMPASS OF SUSTAINABILITY



Age Group: 15 years old and above (activities and depth can be adapted to age)

Group Size: While this activity can be done individually, working together as a team provides a broader range of perspectives for examining an issue more comprehensively

Time Required: 2-3 hours

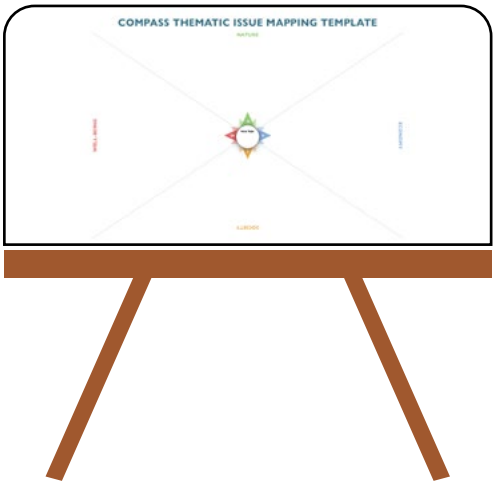
Materials:

- Compass of Sustainability diagram
- Flipchart or other large sheet of paper or whiteboard (if working in a group)
- Permanent markers or pens
- Sticky notes (optional)
- Reference materials related to the thematic issue (articles, reports, data, etc.)

Learning Objectives: The aim of this exercise is to prompt you to examine an issue of your interest through a more comprehensive lens. This approach will enable you to have a clearer understanding of the causes and effects of the issue on the community, empowering you to identify effective solutions. When carrying out this activity you will...

- ...identify the factors or elements connected to the central issue challenges from the four dimensions of sustainability.
- ...discover some causal (cause and effect) system linkages between these factors / elements.
- ...and through discussion with your peers, better understand the dynamics that surround this issue

Setting up:
Print and use the Compass Mapping Template provided on the last page or draw the Compass of Sustainability on a large sheet of paper or whiteboard, **dividing it into the four quadrants: Nature, Economy, Society, and Well-being**.



As a team, agree on a thematic issue you want to explore in greater depth through mapping.

Here are some examples of issues you could choose from, but you are not limited to this list:

- Water pollution
- Transition to renewable energy
- Adapting to the impacts of Climate Change

Write the issue in the middle of the Compass.

Next, collect data, articles, and other resources related to the thematic issue. This information will help you fill in each of the four parts of the compass.

Then, review the Compass of Sustainability to ensure that everyone on your team understands it!

Overview of Compass of Sustainability

The Compass Is Divided Into Four Main Parts: the Quadrants	
N (North) **Nature**	<u>ENVIRONMENTAL ASPECTS AND NATURAL SYSTEMS</u> **Example Components:** Plants, trees, environment, forest, ecosystems, animals, oceans, the biosphere **Example Issues:** Pollution, deforestation, land clearing, coral bleaching, threatened species, enhanced greenhouse effect, extreme weather pattern, natural disasters **(Things to do with the natural environment)**
E (East) **Economy**	<u>ECONOMIC ACTIVITIES AND FINANCIAL SYSTEMS</u> **Example Components:** Money, industry, factories, shops, jobs, trade, market, investment **Example Issues:** Unemployment, affordable housing, unfair trade, access to resources, distribution of wealth, poverty and affluence, economic viability, cost effectiveness **(Things to do with money and generating income to survive)**

S (South) **Society**	<u>SOCIAL SYSTEMS, COMMUNITIES, LAWS AND REGULATIONS, AND CULTURES</u> **Example Components:** Government, culture, friends, community, local councils, religious groups, political parties, sporting clubs, laws, policies **Example Issues:** Design for human scale/community, social justice, racism, war and peace, democracy, equality, gender issues, youth suicide, immigration issues, community building, cultural sustainability, indigenous issues, human rights **(Things to that affect people as a whole)**
W (West) **Well-being**	<u>INDIVIDUAL HEALTH AND HAPPINESS</u> **Example Components:** Personal health, fitness, sense of happiness and satisfaction, religion and spirituality **Example Issues:** Toxic chemicals and health impacts, aesthetics, nutrition, personal development, spiritual development, health problems, disease, personal income, career, sense of self and purpose, happiness **(Things to that affect people personally)**

Watch this video to learn more about the Compass and how to use it to explore an issue of your interest. →

YouTube: The Sustainability Compass
Source: Compass Education (www.compasseducation.org)

Activity Steps

Step 1: Brainstorm and list factors

Begin brainstorming the various factors related to the thematic issue, one Compass quadrant at a time.

- List them under the relevant quadrant.
- You can use sticky notes for easy adjustments if needed.
- Some factors may overlap multiple quadrants. Place these factors at the intersections of relevant quadrants.

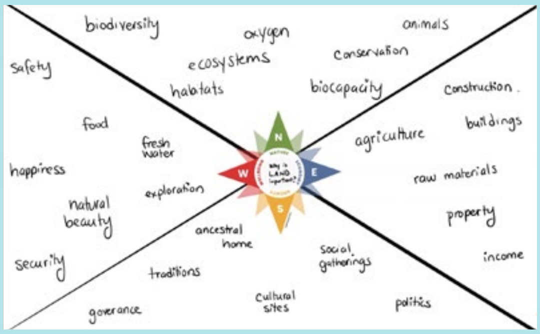
Step 2: Analyze interconnections

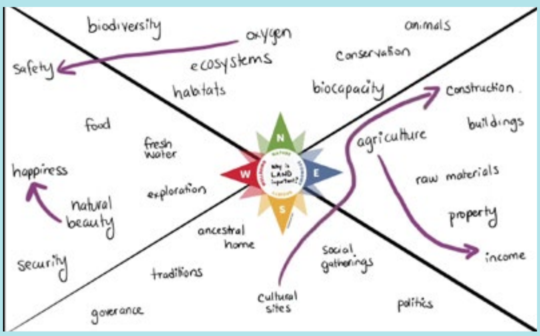
- Discuss with your teammates to identify how factors in different quadrants interrelate in a cause-and-effect relationship (e.g. how agriculture produce affects people's income).
- Draw arrows to indicate connections between them. The arrowhead should point to the factors that are affected by other factors.
- Repeat the same process until you feel satisfied with the map your team has produced.

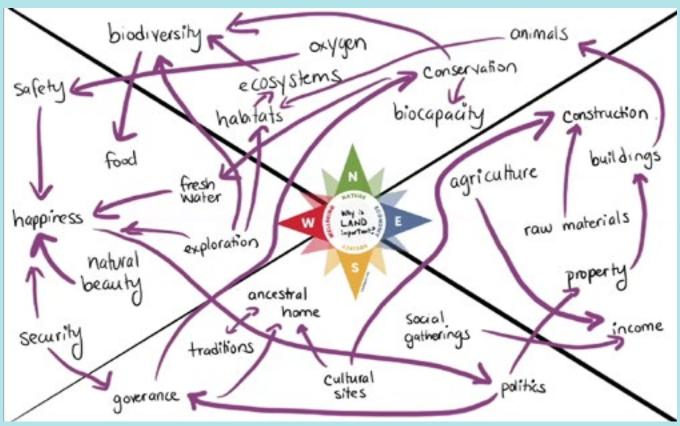
Step 3: Reflection

- Together with your teammates, discuss and reflect on the key insights and patterns that emerge from the mapping process.
  - What are the key connections that you see?
  - What do you notice from seeing all of these connections?
  - Are there any items on the map that are more connected, compared to others?
- Based on the insights, brainstorm potential strategies to address the thematic issue of sustainably.
- Ensure the strategies consider the impacts across all four quadrants of the compass.

By following these steps, you can create a comprehensive and balanced understanding of a thematic issue through the lens of sustainability, facilitating informed decision-making and strategic planning.



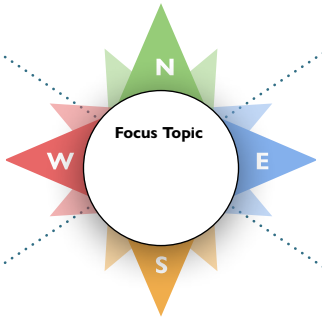




COMPASS THEMATIC ISSUE MAPPING TEMPLATE

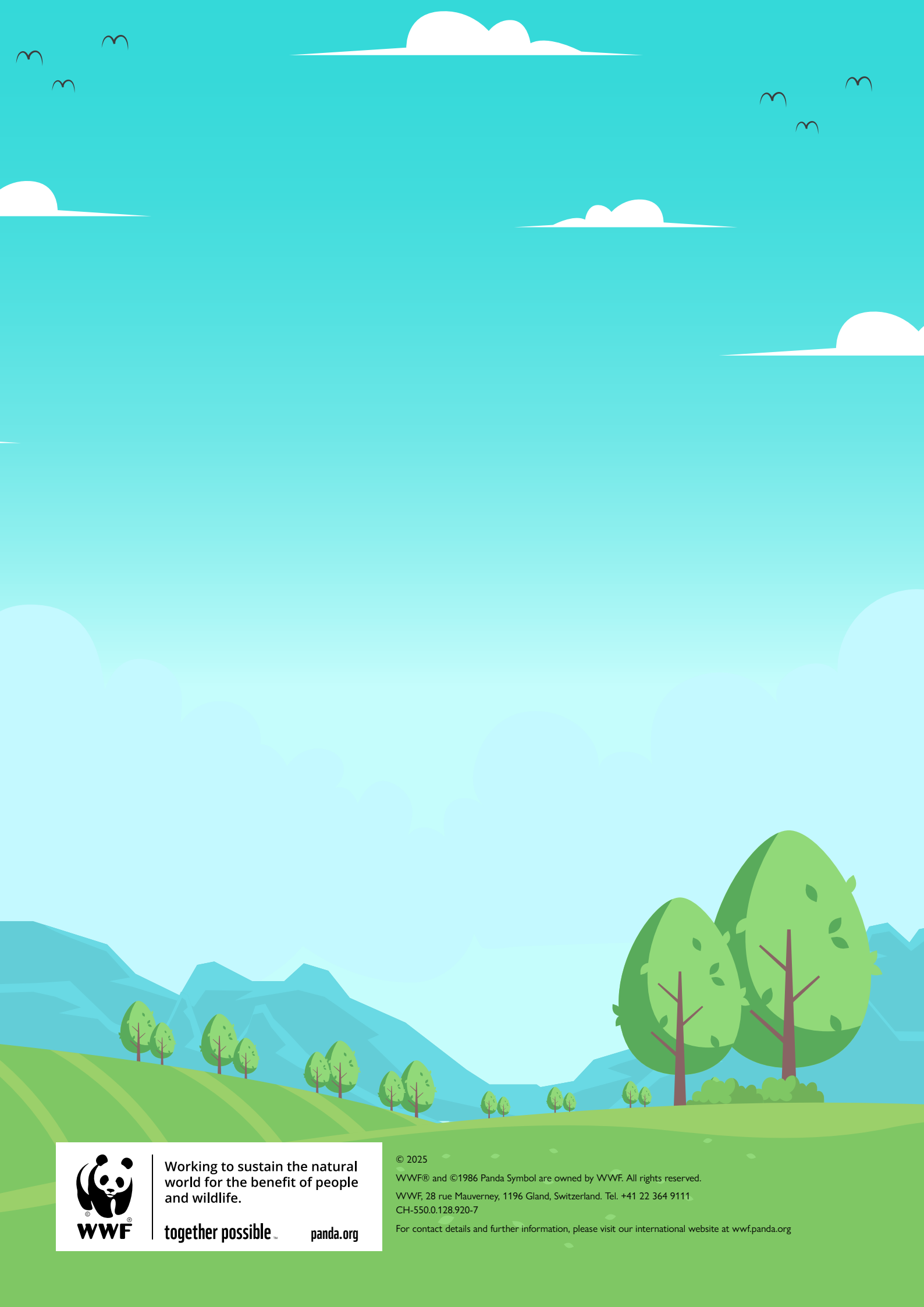
NATURE

WELL-BEING



ECONOMY

SOCIETY



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