WELCOME TO THE ECO LEADERS GUIDE!

Over the next few pages, you'll find **'Chapter 1: Exploring the Issues of the Greater Mekong Subregion'** from the Eco Leaders Guide. Use the hyperlinks below to quickly access specific sections, activity guides, worksheets, templates or other resources.

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Eco Leaders Guide

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

Disclaimer:
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CONTENTS

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CHAPTER 1

EXPLORING THE ISSUES OF THE GREATER MEKONG SUBREGION (GMS)

INTRODUCTION

Chapter 1 of this toolkit dives into the core environmental challenges facing the Greater Mekong Subregion (GMS)—namely managing freshwater ecosystems sustainably, tackling climate change, and transitioning to renewable energy. This chapter breaks down each theme clearly, helping you grasp the essential points. You'll find a range of environmental education activities, designed for both individual and group participation, that explore these topics deeper and understand what changes are needed for a sustainable future in the GMS. Plus, you'll have access to extra resources and videos to expand your knowledge further. The chapter wraps up with an overview of key international and regional commitments like those of the Association of Southeast Asian Nations (ASEAN) and the Mekong River Commission (MRC), showcasing how the GMS countries are collaborating to address these environmental challenges. By the end of this chapter, you'll be well-equipped with a foundational understanding of the environmental dynamics in the Mekong region.

OVERVIEW

The GMS is a vibrant biologically and culturally diverse region located in the heart of Southeast Asia. The GMS is comprised of a mosaic of stunning landscapes—from sprawling river basins and lush plains to towering mountains and thick forests. It is rich in natural resources like fertile land, minerals, and abundant water, and is a globally important storehouse of biological diversity. It is an abundant food source for the world. The GMS is primarily defined by the iconic Mekong River, which starts in the mountains of southern People's Republic of China (PRC), then flows through Myanmar, Laos, Thailand, Cambodia, and Viet Nam. The Mekong River is a vital lifeline and a unifying thread that intricately connects the cultures, economies, and environments of these diverse nations.

For youth in these countries, the Mekong River symbolizes a shared heritage and collective destiny. It nourishes the lands on which millions depend for agriculture, supports bustling economies through trade and transport, and hosts an astonishing array of biodiversity that underscores the ecological wealth of Southeast Asia. As young leaders, understanding and protecting the Mekong River and other biodiversity-rich freshwater ecosystems against unsustainable development and climate change is not just about preserving nature, but is vital to safeguarding a shared future where economic prosperity, social cohesion, and cross-border cooperation can flourish and thrive.

Figure 1. The Greater Mekong Subregion map

Home to over 340 million people, the GMS is a melting pot of ethnic groups, cultures, and languages. Its deep cultural roots are reflected in the region's eventful history, vibrant trade, and the interaction among its diverse communities. Each country in the GMS brings its own unique flavor with distinct traditions, customs, and delicious cuisines. Cities like Bangkok, Hanoi, Ho Chi Minh City, Phnom Penh, Vientiane, and Yangon are not just urban hubs but cultural beacons that drive the region's economy and showcase its dynamic urban culture.

The economic development of the GMS is largely dependent on natural ecosystems and the food, water, energy, and other essentials they provide. The long-term viability of its ecological integrity, rich biodiversity, and economic development will depend on how these natural resources are protected, managed, restored, improved, and developed. It will also be determined by how the region adapts and strengthens its resilience to climate change and other future global and planetary events.

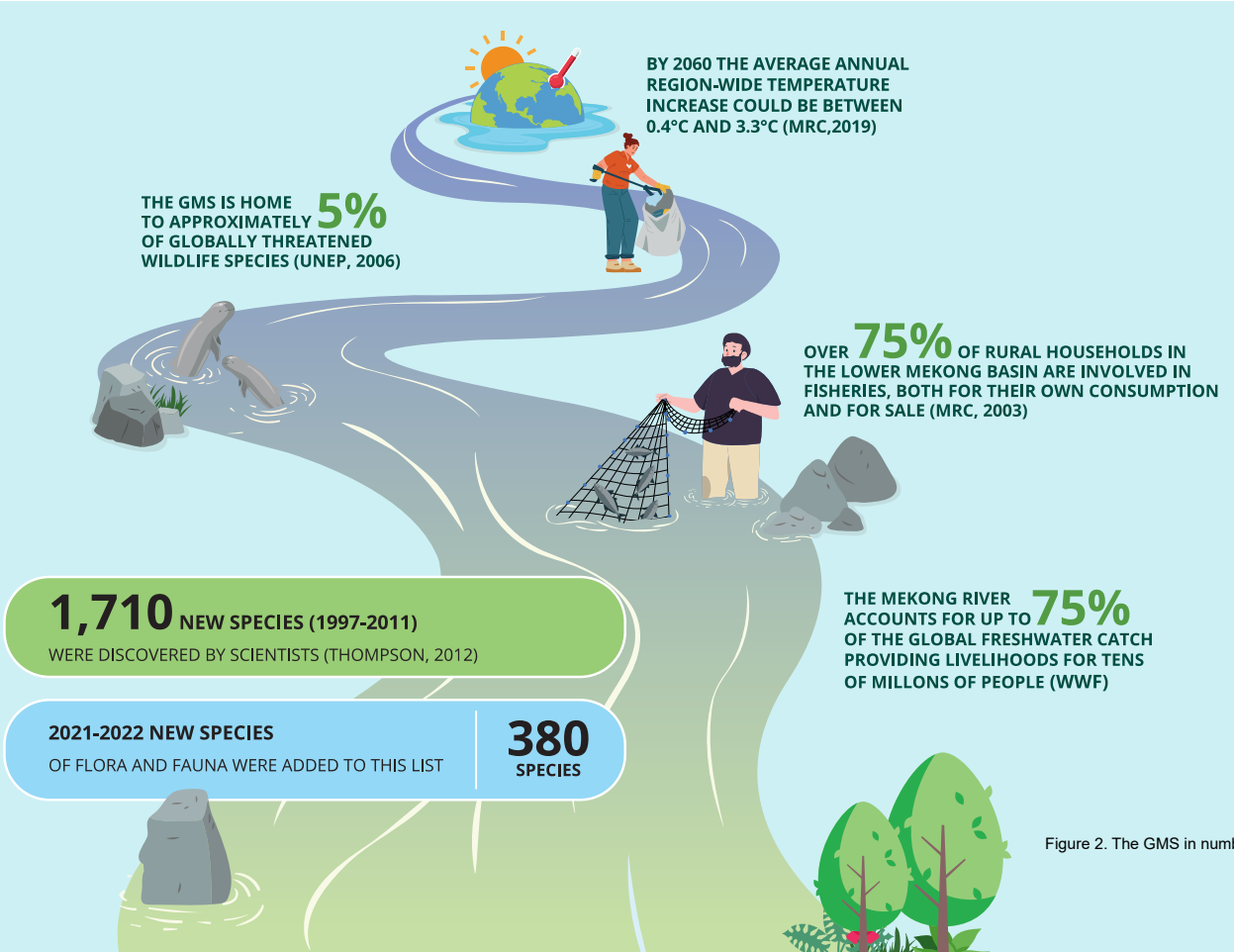


Figure 2. The GMS in numbers

GMS ENVIRONMENT CHALLENGES

The GMS, which includes the six countries of Cambodia, Laos, Myanmar, Thailand, Viet Nam, and the Yunnan province of southern PRC, has become one of the fastest-growing regions in the world. However, the significant increase in population over the past four decades, coupled with rapid economic growth, has resulted in a number of serious environmental issues threatening the countries' future sustainable development. These include a rapid depletion of natural resources and a significant decrease in environmental quality across the board, in addition to ecosystem degradation and biodiversity loss. These issues could slow down future economic growth and make it harder to reduce poverty in the six countries that make up the GMS. **Some of the most pressing environmental issues that the countries of the GMS are collectively facing include:**

HYDROPOWER DEVELOPMENT

Hydropower dam development throughout the GMS saw a dramatic increase in 2010, particularly in Laos, China, and Cambodia, with Laos itself hosting 61 hydropower dams by the first half of 2019.[1] Hydropower dams bring significant benefits, like renewable energy, improved water storage and flood control, and they boost the economy by exporting energy. However, they also have serious downsides. Dams disrupt ecosystems, harming fish populations and biodiversity that many people depend on for their livelihoods. They also change how sediment flows in rivers, which can mess up agriculture, cause erosion along riverbanks, displace communities, and lead to conflicts over water rights.

DEFORESTATION

The total forest coverage of the six GMS countries was estimated at 1.2 million square kilometers (km2) in 2015, or 52% of the subregion's total land area. Myanmar has the largest forest area among the GMS countries, and Laos has the highest percentage of forest cover.[2] Unfortunately, deforestation is still a major issue for some countries in the GMS. The pressures on forests in the GMS are generally high and increasing. In Cambodia and Laos for example, key pressures have been caused by forest conversion for agriculture and infrastructure development, spurred on by government economic development policies.[3] Primary forests have decreased substantially in Cambodia, Laos, and Viet Nam, with worrying implications for dependent wildlife.[4]

WASTE MANAGEMENT

Countries in the GMS are grappling with significant waste management challenges, largely driven by rapid urbanization and economic development. As populations and consumer consumption increases, and economies grow, all of the countries of the GMS are struggling to handle the increasing amount of waste. Many towns and communities, especially rural communities, lack waste collection and management services, which leads to open garbage dumping and burning, and results in a number of environmental problems, especially water and land pollution and significant air quality issues.

WATER POLLUTION

In most parts of the GMS, the rivers have pretty good water quality.[5] However, problems do exist, especially in river deltas and areas where a lot of people live. Pollution from agriculture, industry, and urban areas contaminate waterways, lakes and wetlands. These problems often arise because domestic and industrial wastewater isn't properly treated. Cities, in particular, see more water pollution because of all the waste and dirty water they dump into rivers. Additionally, agricultural chemicals seriously pollute rivers like the Chao Phraya, Mekong and Red. In northeastern Thailand and central Laos, irrigation methods are causing soil saltiness, which also messes with water quality. Plus, soil erosion in hilly areas contributes to the water pollution issue. Water pollution affects aquatic ecosystems, human health, and agricultural productivity.

1 Soukhaphon, Baird, and Hogan. 2021. The Impacts of Hydropower Dams in the Mekong River Basin: A Review
2 FAO. 2015. Global Forest Resources Assessment 2015. Rome.
3 Asian Development Bank, October 2018. Greater Mekong Subregion Environmental Performance Assessment 2006–2016.
4 Yasmi et al. 2017. Forest Change in the Greater Mekong Subregion (GMS): An Overview of Negative and Positive Drivers. Bangkok: FAO.
5 ADB, October 2018.

AIR QUALITY

Large cities in the GMS are increasingly experiencing poor air quality. Transportation is usually the biggest culprit behind this air pollution in urban areas. In rural areas, the open burning of domestic waste and agricultural residues are the main causes of air pollution. The main pollutants that people worry about are particulate matter (PM)—especially the tiny particles called PM10 and PM2.5—and gases like nitrogen and sulfur oxides.[6] The good news according to the World Health Organization (WHO) is that sulfur dioxide levels have decreased across the region overall and are still under the safety limits. However, the total amount of PM often hits levels that are bad for human health. Meanwhile, nitrogen dioxide levels have been slowly rising and are now just over the WHO's recommended limit.[7] Air pollution is a major environmental risk to human health, increasing the burdens of stroke, heart disease, lung cancer, and both chronic and acute respiratory diseases, including asthma.

CLIMATE CHANGE

Over the past two decades, climate change has emerged as an urgent issue for countries in the GMS. This shift happened as greenhouse gas (GHG) emissions increased and the harmful effects of climate change became more noticeable. Although the subregion's contribution to global emissions remains low, increasing energy use, expanding transportation, deforestation, and land use changes are all contributing to accelerating GHG emissions. Climate change is a major challenge for the economic development of the GMS, as it will impact both people's lives and the natural environment. Climate change is also affecting energy and transport systems in the GMS countries, threatening lives, property, and other assets throughout the region. Extreme weather events, which have already hit the area hard, are expected to become more frequent and intense. These events can disrupt agriculture, infrastructure, and livelihoods, exacerbating poverty and food insecurity.

ECOSYSTEM DEGRADATION AND LOSS OF BIODIVERSITY

The GMS is one of the world's richest biodiversity hot spots. It's home to around 430 mammal species, 800 reptiles and amphibians, 1,200 bird species, and 20,000 plant types. Between 1997 and 2015 scientists discovered 2,409 new species there. Many of these species are at risk of extinction, including some that are critically endangered.[8] Habitat destruction, overexploitation of natural resources, and climate change are leading to a loss of biodiversity in the Mekong region. This loss threatens the region's diverse ecosystems and the services they provide, such as water supply, nutrient cycling, micro-climate regulation, biodiversity support, commercial and subsistence fisheries, flood regulation, carbon sequestration, recreation and tourism, and cultural and spiritual beliefs and rituals (e.g. Loy Kratong festival in Thailand).

If the countries of the GMS do not improve their policies, planning and management, the current development models could irretrievably damage the natural environment and the quality of life of future generations. This unsustainable path also risks seeing increased biodiversity loss and extinctions, more frequent and bigger impacts from climate change, food shortages, rising food prices, health crises like COVID-19 and dengue fever, and environmental damage and natural resource scarcity that could affect millions of families and jeopardize national economies and small businesses. To address these issues, it is essential for governments, civil society, and businesses to join forces to promote sustainable development, conserve our natural resources, and combat climate change. International cooperation is also vital to effectively tackle these complex challenges and implement lasting solutions.

6 Asian Development Bank, October 2018. Greater Mekong Subregion Environmental Performance Assessment 2006–2016.
7 ADB, October 2018.
8 WWF. Wildlife of the Greater Mekong. http://greatermekong.panda.org/discovering_the_greater_mekong/species/

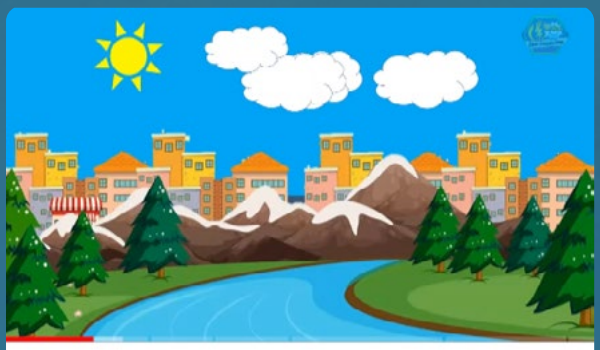
EXPLORING THE THREE THEMATIC ISSUES

The three environmental topic areas of particular emphasis for the GMS are 1) sustainable freshwater management, 2) climate change mitigation and adaptation, and 3) the just transition to a renewable energy future. These three topic areas, as they exist in the GMS, are explored in more detail in the following section.

A. Sustainable Freshwater Ecosystem Management

What is a Freshwater Ecosystem and Why is it Important?

Freshwater ecosystems include rivers, streams, lakes, ponds, groundwater, cave water, springs, floodplains, and wetlands like bogs, marshes, and swamps. These places are vital homes for many animals and plants. They also provide essential resources for human societies like food and fiber, supporting the economies and livelihoods of rural communities in the GMS. However, these ecosystems face significant threats. In recent years, more than 20% of the world's 10,000 freshwater species have become extinct, endangered, or threatened, making these environments the most at risk for losing species.[9]



Watch YouTube video here: https://www.youtube.com/watch?v=VndXCh1t160

9 Asian Development Bank, October 2018. Greater Mekong Subregion Environmental Performance Assessment 2006–2016.

Key Features of Freshwater Ecosystems

Rivers

Rivers are natural flowing bodies of water, usually freshwater, that travel along a channel to a sea, lake, or another river. They are vital to both nature and human societies for many reasons. For nature, rivers support a wide variety of plants and animals by providing habitats and essential water resources necessary for life. They play a critical role in shaping the earth's landscape by eroding land and depositing soil in new areas, which helps create fertile lands that sustain diverse ecosystems. For human societies, rivers are indispensable sources of water for drinking, agriculture, and sanitation. They have been central to human civilization, supporting farming, transportation, and as power sources through hydropower. Furthermore, rivers are integral to many cultural and recreational activities, enhancing community well-being and economic development.

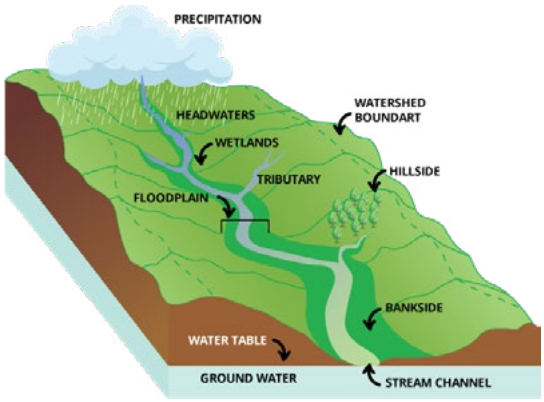


Figure 3. The anatomy of a catchment

Catchment basins or watersheds

Rivers are part of larger areas called catchment basins or river basins. A catchment basin includes all the land where water drains into the same river or lake. Large river basins, like the Mekong River Basin, consist of many smaller catchment basins formed by tributaries—smaller rivers, creeks, and streams. These smaller waterways eventually flow into the larger river downstream. These catchment basins shape the geography of an area, influencing the local climate, types of plants and animals, soil conditions, and even the lifestyles of the communities living there. Unlike political boundaries of states or countries, the natural boundaries of catchment basins create a sense of connection and belonging that is based on the shared natural environment.

A catchment basin strongly influences who we are as people and societies, and how we live our lives, even as far as the kind of art, music and literature we create. People who live in the floodplain, for example, sing different songs than people who live up in the forested mountains, draw different pictures, and often use different materials to create their artwork. The connection between landscapes and the human imagination is reciprocal.

Floodplains and deltas

A river flows within a channel, which is the space between its banks over a stream bed. In larger rivers, there's often a floodplain, an area shaped by floods when the river overflows its channel. These floodplains can be quite broad compared to the river itself. In cities, the lines between the river channel and the floodplain often blur as these areas are commonly developed for housing and industry. Also, rivers that carry a lot of sediment can form large deltas at their ends where they meet the sea or a lake, if the conditions are right.

Wetlands

Wetlands are diverse areas that can include basins, plains, springs, and other types of water bodies, both natural and human-made. They can contain water that is temporary or permanent and vary from freshwater to saltwater, located either along the coast or inland. Wetlands are generally shallow, with water depths not exceeding six meters. These ecosystems are crucial for environmental health because they provide fresh water, store excess water, protect shorelines from erosion, block saltwater from moving inland, and help prevent pollution by filtering out sediments and harmful substances.

Wetlands are incredibly important because they support a wide variety of wildlife, including both water-loving and land-based animals. They offer critical habitats for migratory birds and serve as breeding grounds for numerous fish species, as well as rare marine mammals like dugongs, manatees, and freshwater dolphins. In Southeast Asia, wetlands are especially vital for rural communities, providing fresh water that many people rely on for income and a significant portion of their diet through fishing. The direct benefits wetlands provide to both humans and the environment highlight the crucial need to preserve these unique ecological areas.

Bueng Boraphet wetland, Nakorn Sawan, Thailand

Lakes and ponds

Lakes and ponds are still bodies of freshwater that form through various processes, both natural and human-made (such as damming of rivers). Lakes are generally larger and deeper than ponds, featuring different zones that support diverse life forms and can be found in almost any climate, from the Arctic to the tropics. In contrast, ponds are smaller, shallower, and tend to have more consistent temperature and oxygen levels throughout. They can be temporary or permanent and are more sensitive to environmental changes due to their size.

Both lakes and ponds are vital to freshwater ecosystems, offering habitats for many species, including those that are unique or endangered. They help in nutrient cycling, such as carbon, nitrogen, and phosphorus, and manage water flow and quality, serving as natural buffers against floods and droughts. They also play a role in regulating the global climate by storing carbon and through evaporation. Rich in biodiversity, these water bodies support various organisms from aquatic plants and tiny algae to fish, amphibians, and birds, making them essential for the health of the ecosystem and the survival of numerous species.

GMS Freshwater Ecosystems Services

Ecosystem services refer to the various benefits that humans derive from ecosystems, which are the interactions between living organisms and their physical environment. These services are essential for sustaining life, well-being, and economic activities. Rivers and river basins provide a variety of ecosystem services that are essential for both natural ecosystems and human societies. Here are some of the key services they offer:

Water Supply: Freshwater ecosystems are a critical source of water for drinking, irrigation, and industrial use.

Habitat Provision: They provide habitats for a diverse array of wildlife, including many species of fish, amphibians, birds, and plants.

Food Provision: Many freshwater ecosystems are vital for fisheries, which are a significant source of protein and livelihood for millions of people worldwide.

Water Purification: Freshwater systems naturally filter pollutants and pathogens from water through biological, chemical, and physical processes, improving water quality.

Flood Regulation: Wetlands and lakes absorb excess rainfall and release it slowly, reducing the severity of floods and mitigating damage to environments and human communities.

Climate Regulation: Freshwater ecosystems play a role in regulating climate through carbon sequestration and influencing local and regional temperatures.

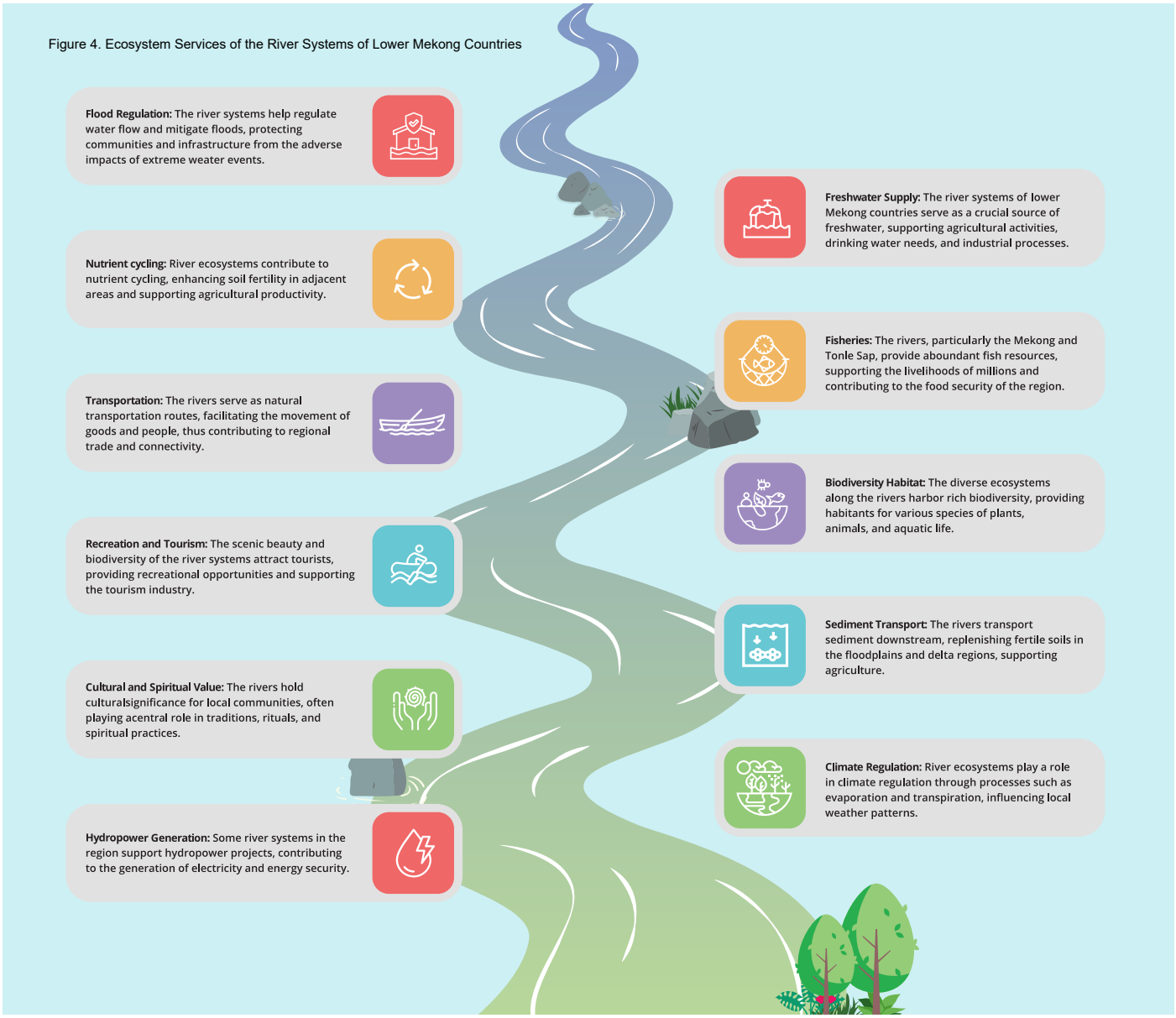
Recreational Opportunities: Many freshwater ecosystems provide spaces for recreational activities such as fishing, boating, and bird-watching, which are important for human well-being and local economies.

Cultural Value: Rivers, lakes, and wetlands have significant cultural, aesthetic, and spiritual importance in many societies.

Nutrient Cycling: These ecosystems are crucial in the cycling of nutrients, including nitrogen, phosphorus, and carbon, which supports plant growth and regulates ecosystem health.

Biodiversity Support: Freshwater ecosystems are hotspots of biodiversity, supporting many endemic and rare species that are not found elsewhere.

Figure 4. Ecosystem Services of the River Systems of Lower Mekong Countries



What Do We Mean When We Say We Are Aiming for "Sustainable Freshwater Ecosystem Management"?

Sustainable freshwater ecosystem management involves a holistic approach that considers ecological, social, economic, and cultural factors to maintain the health, functionality, and resilience of freshwater ecosystems. Some key guiding attributes of sustainable freshwater ecosystem management include the following:

Ecological Integrity: Keeping our freshwater ecosystems healthy is crucial. This means protecting the variety of life they support, preserving different habitats, keeping the water clean, and letting natural processes like nutrient cycling and water flow happen undisturbed.

Integrated Water Resources Management (IWRM): IWRM is all about managing our water resources smartly and sustainably. It takes into account how all the different water sources, ecosystems, and human activities connect, and aims to balance the needs of people with the need to protect nature.

Stakeholder Engagement: Managing freshwater ecosystems well means getting everyone involved—from local governments and communities to indigenous groups, NGOs, and businesses. This way, everyone's views and needs are considered in making decisions.

Adaptive Management: Freshwater ecosystems are complex and can be unpredictable. Adaptive management means we keep an eye on these ecosystems, learn as we go, and tweak our strategies based on what works and what doesn't to better protect and restore them.

Ecosystem-Based Approaches: Instead of just focusing on saving specific species or spots, it's about looking at the whole picture. This approach works to keep the entire ecosystem intact and healthy, recognizing how everything within it is connected.

Sustainable Water Use: It's important to use water wisely, whether it's for drinking, farming, industry, or keeping ecosystems thriving. This means promoting ways to use water more efficiently, keeping pollution in check, and making sure there's fair access to water for everyone and everything, including nature.

Conservation and Restoration: To keep freshwater ecosystems functioning well, we need to protect and fix them when they're damaged. This can involve setting up protected areas, restoring habitats, and managing threats like invasive species and pollution.

Climate Change Adaptation: With climate change affecting freshwater ecosystems, it's key to include strategies that help these areas withstand changes and recover from extreme weather like floods and droughts. This could mean restoring ecosystems to make them stronger, improving how we store and manage water, and taking steps to handle extreme weather better.

Major River Basins and Freshwater Ecosystems of the GMS

The GMS is home to several major river basins and freshwater ecosystems, which play crucial roles in supporting livelihoods, biodiversity, and ecosystem services. Some of the major river basins and freshwater ecosystems of the GMS include:

Mekong River Basin: The Mekong River is the most significant river system in the GMS, spanning approximately 4,350 kilometers from its source in the Tibetan Plateau to its delta in Viet Nam. The Mekong River Basin is a lifeline for millions of people, supporting agriculture, fisheries, transportation, and hydropower generation. It is home to diverse ecosystems, including floodplains, wetlands, and riparian forests.

Tonle Sap Lake: Located in Cambodia, Tonle Sap Lake is Southeast Asia's largest freshwater lake, playing a vital ecological and economic role for the country. It is unique due to its flow changing direction twice a year. During the dry season, it drains into the Mekong River at Phnom Penh. However, when the monsoon season comes, the lake expands significantly as the Mekong's flow reverses, filling the lake and surrounding floodplain with water. This annual flood pulse is the driving force behind the lake's incredible productivity and biodiversity. The lake is a critical habitat for fish, birds, and other wildlife, as well as a source of livelihood for local communities through fishing and agriculture. Ecologically, Tonle Sap Lake is a hotspot for biodiversity, supporting over 300 species of fish, numerous bird species, reptiles, and mammals, making it a critical habitat for conservation. Its floodplain acts as a natural flood mitigation system, absorbing and then slowly releasing water, which helps to prevent flooding downstream. The lake and its surrounding floodplain are also crucial for local agriculture, providing fertile soils for crop production.

Figure 5. Major river basins of mainland Southeast Asia
(Source: Encyclopædia Britannica)

Red River Basin: The Red River, also known in Chinese as the Honghe River, flows from Yunnan province in PRC through northern Viet Nam, forming the Red River Delta before emptying into the Gulf of Tonkin. The Red River Basin covers a vast area of approximately 169,000 square kilometers and encompasses a diverse range of landscapes, including mountains, plains, and deltaic regions. The basin supports agriculture, aquaculture, and hydropower generation, and is home to diverse ecosystems, including forests, wetlands, and karst

landscapes. The basin is home to a significant portion of Viet Nam's population, with millions of people living along its banks and relying on its resources for their livelihoods. However, the basin faces various challenges, including sedimentation, water pollution, land subsidence, and flooding, exacerbated by rapid urbanization, industrialization, and unsustainable land-use practices.

Chao Phraya River Basin: The Chao Phraya River Basin covers a substantial area of central Thailand, spanning approximately 160,000 square kilometers. It is primarily located in the central plains region, with the river flowing from the far north of the country through the central plains before draining into the Gulf of Thailand. The basin is a major agricultural and industrial hub, supporting rice cultivation, urbanization, and water-based transportation. The fertile alluvial plains along the riverbanks are highly productive and contribute significantly to the country's food security and economy. The Chao Phraya River Delta is one of the most densely populated and economically important regions in Thailand as it flows directly through the capital city, Bangkok, and is close to several other major urban centers. The Chao Phraya River Basin is home to diverse ecosystems, including wetlands, marshes, and riparian forests.

Irrawaddy River Basin: The Irrawaddy River Basin covers a large area of approximately 255,000 square kilometers in Myanmar, making it the country's largest river basin. The basin extends from the northern highlands near the Himalayas to the southern delta region, draining into the Andaman Sea. The Irrawaddy River originates from the confluence of the Mali and N'mai rivers in northern Kachin State and flows southward through central Myanmar before reaching the Irrawaddy Delta and emptying into the Andaman Sea. The Irrawaddy River Basin is ecologically diverse, supporting a wide range of habitats, including tropical forests, wetlands, and mangrove swamps, and is home to numerous plant and animal species, including several endangered species such as the Irrawaddy dolphin and the Irrawaddy river shark.

Salween River Basin: The Salween River Basin covers a vast area of approximately 324,000 square kilometers, extending across PRC, Myanmar, and Thailand. The Salween River starts from the Tibetan Plateau and flows 2,800 kilometers through Yunnan province in PRC, Myanmar, and Thailand before emptying into the Andaman Sea. It is one of the longest free-flowing rivers in the world, with much of its course remaining untouched by dams and other major development projects. The basin is characterized by rugged mountains, deep gorges, and diverse ecosystems, including forests, wetlands, and riverine habitats. It is home to numerous ethnic minority groups and supports biodiversity hotspots, with many endemic and endangered species, including the Shan Tahr and the Irrawaddy dolphin.

Sesan-Srepok River Basin: The Sesan and Srepok Rivers are major tributaries of the Mekong River, flowing through northeastern Cambodia and Viet Nam. This basin is renowned for its rich biodiversity, including diverse flora and fauna, and serves as a critical habitat for several endangered species. The basin also plays a vital role in supporting local communities through agriculture, fisheries, and hydropower generation. However, it faces various challenges such as deforestation, habitat loss, water pollution, and conflicts over water resource management due to competing demands from agriculture, industry, and infrastructure development.

Watch the documentary here: https://youtu.be/_AqvJaHk-N4

Video: Mekong the Mother

This 47-minute documentary film, entitled Mekong the Mother, offers a holistic view of the significant role that the Mekong River plays in the lives of people living in the five countries of the lower Mekong River Basin. It is part of the Mekong River Commission's on-going campaign to increase awareness of Mekong issues and the need for strong regional cooperation in order to manage natural resources for the population of 60 million living in the Mekong River Basin.

Primary Threats to Freshwater Ecosystems in the GMS

Freshwater ecosystems in the GMS face several threats that jeopardize their health and sustainability. Rapid industrial growth and urbanization are leading to increased pollution from waste and chemicals that end up in rivers and lakes, severely affecting water quality and aquatic life. Extensive dam construction disrupts the natural flow of rivers, impacts fish migration, and alters sediment transport, which can lead to reduced fish populations and degraded river habitats. Overfishing and illegal fishing practices further threaten fish stocks and biodiversity. Additionally, climate change is exacerbating these issues, causing more extreme weather events like droughts and floods that strain these ecosystems even further. These combined threats not only harm the biodiversity of the region but also the communities relying on these waters for their livelihoods and cultural practices.

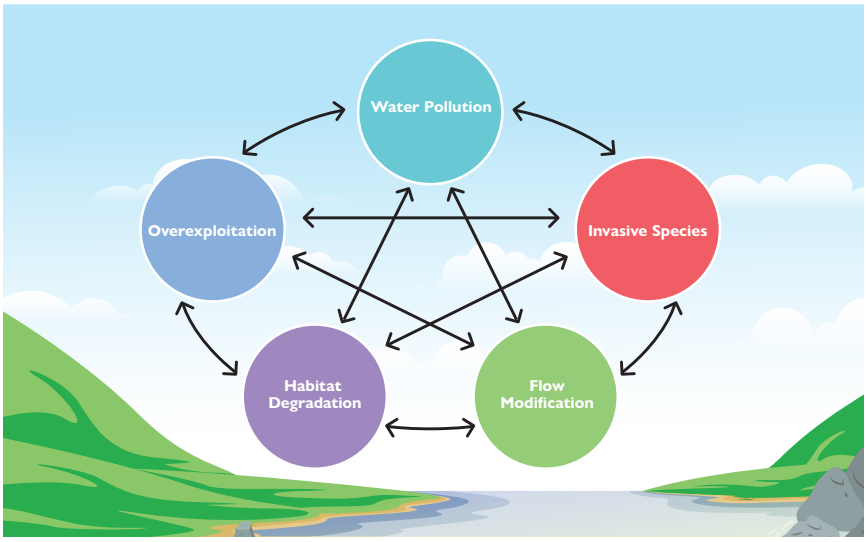


Figure 6. Primary threats to freshwater ecosystems in the GMS

Freshwater Ecosystem Environmental Education Activities

Learn more about the pressures on freshwater ecosystems as well as their role and value in how communities interact with, define themselves and understand the importance of freshwater.

Activity 1.1: Watershed Puzzle
This puzzle helps you discover how different developments along a river's course can affect its water quality, while demonstrating the interconnectedness of actions in a watershed and the shared responsibility for environmental stewardship.

Activity 1.2: Freshwater Ecosystem Observation: How healthy is it?
In this environmental education lesson, you will conduct a scientific investigation of a local river, stream, or canal to assess its environmental health. By using your senses and cognitive skills, you will explore the habitat's biodiversity and water quality, culminating in the creation of a report on your findings. You can then refine your findings using peer or mentor feedback before submitting to a local environmental organization.

Activity 1.3: Investigating Community Links with their Water Ecosystem
In this assignment, participants will explore community perceptions about the local water ecosystems such as rivers, streams, canals, or wetlands. They will investigate how these water bodies impact daily life and identify prevailing community concerns regarding these waterways. Following the investigation, participants are tasked with writing a news article or blogpost to share their findings, enhancing their understanding of public opinion and communication skills.

Library for additional resources

Below are some additional online information resources available for you to dive deeper into this topic of freshwater ecosystem management in the Mekong region.

- WWF, 2013 Ecosystems in the Greater Mekong: Past trends, current status, possible futures. This report gives an overview of the current status and potential future of the principal ecosystems of the GMS and, by association, the well-being of millions of people who are dependent on the region's ecosystem services.
- WWF, Greater Mekong page on website: worldwildlife.org/places/greater-mekong
- IUCN, 2012. Mekong River Basin - Mobilising grassroots engagement and facilitating high-level dialogue for transboundary water management.
- Reuters, December 2023. How Dams Starve the Mekong River Delta of Vital Sediment
- Video: A Teacher's Journey To Protect The Mekong River
- Video: Prachathai - Community Rights in the Mekong Sustainability Management
- Video: Heinrich Böll Stiftung Southeast Asia, 3 December 2021, The Mekong River — Concerns, Struggles and Hopes with Tipakson Manpati.
- Asian Development Bank, 2012. Greater Mekong Subregion ATLAS OF THE ENVIRONMENT, 2nd Edition
- UN Water, 2021. Progress on Freshwater Ecosystems: Global indicator 6.6.1 updates and acceleration needs

B. Climate Change

Climate change is about how our planet's weather patterns and temperatures are changing over time. This change is mostly driven by human actions like burning fossil fuels, cutting down forests, generating lots of garbage and waste, intensive farming and industrial activities that increase levels of greenhouse gases such as carbon dioxide and methane in the atmosphere (see box for more details). These gases trap more heat, warming the Earth more than usual. This warming leads to extreme weather like heatwaves, droughts, heavy storms, and rising sea levels. All these changes can harm nature, our health, and the economy.

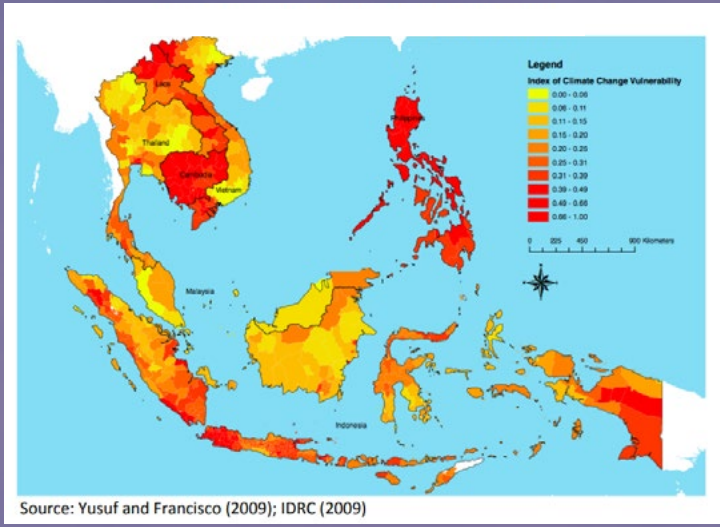
The main causes of climate change include….

- **Burning Fossil Fuels:** When coal, oil, and natural gas are burned for energy (like powering cars, generating electricity, and heating homes), they release carbon dioxide (CO2) and other greenhouse gases.
- **Deforestation:** Cutting down forests reduces the number of trees that can absorb CO2 from the air through photosynthesis. This not only releases the carbon stored in trees but also decreases the overall capacity of forests to act as carbon sinks.
- **Agriculture:** This sector contributes to climate change through methane emissions from livestock and rice fields, nitrous oxide from fertilized soils, and CO2 from the conversion of land for crop production and livestock grazing.
- **Industrial Processes:** Manufacturing industries release a variety of greenhouse gases, including CO2, methane, and nitrous oxide, as well as fluorinated gases, which are potent greenhouse gases used in air conditioning, refrigeration, and manufacturing.
- **Waste Management:** Landfills produce methane as organic waste decomposes. Additionally, waste incineration produces CO2.
- **Land Use Changes:** Besides deforestation, other land use changes that affect the balance of greenhouse gases include urbanization, which often involves clearing vegetation and increasing heat absorption by concrete and asphalt.

Source: The Global Goals, An Idiot's Guide to Saving the Planet: Episode 6 – Climate Action.

How is climate change affecting the countries of the GMS?

Overview of Climate Change Vulnerability in Southeast Asia: This assessment map was constructed by using climate hazard maps, sensitivity maps, and adaptive capacity maps, based on the United Nations' IPCC framework for vulnerability assessment. The map gives a quick, informative look at the region. Based on this mapping assessment, all the regions of the Philippines; the Mekong River Delta in Viet Nam; almost all the regions of Cambodia; north and east Laos; the Bangkok region of Thailand; and west Sumatra, south Sumatra, west Java, and east Java of Indonesia are among the most vulnerable regions in Southeast Asia.[10] The study was conducted by the Environment and Economy Program for Southeast Asia (EEPSEA).



Source: Yusuf and Francisco (2009); IDRC (2009)

Figure 7. Climate change vulnerability assessment map

10 Yusuf, Anshory & Francisco, Herminia. (2009). Climate Change Vulnerability Mapping for Southeast Asia.

Likely Impacts of Climate Change on GMS Countries

Some of the most significant impacts that are beginning to be observed and will likely increase in the future include the following:

Agriculture and Food Security: The region's farmers rely heavily on the Mekong River's regular flow to time their crop cycles. However, climate change is messing with these water patterns, affecting when and how crops grow. Rising temperatures, shifts in rainfall, and more frequent extreme weather like droughts and floods could lead to fewer crops, putting the region's food supply at risk.

Water Resources: The region's major rivers are changing because the rain patterns are shifting. This means more severe weather, with floods and droughts happening more often and more intensely. These changes make it tough to manage water supplies, impacting farming, fishing, and power production from rivers. Climate change could also make water even scarcer in parts of the GMS. Less rain and higher temperatures mean there might be less water available on the surface in some places.

Biodiversity: Climate change is a big problem for wildlife in the region. Changes in weather, like shifts in temperature and rain, are messing up the natural homes of plants and animals, making it too hot, cold, wet, or dry for some to survive. Because it is getting warmer, many species are moving to cooler areas higher up or farther north, which shakes up the balance of local ecosystems. This shift can bring new rivals, predators, or diseases that threaten native species. Some animals and plants can't move to different regions because of barriers or because the climate is changing too quickly, leading to their disappearance in certain areas.

Ecosystem Services: The loss of different plant and animal species due to climate change can mess with important natural processes like pollination, water cleaning, and carbon storage, all of which are crucial for our well-being. This disruption can hit people's livelihoods hard, especially those who rely on natural resources to make a living. It can also create a cycle of worsening environmental damage, making things even tougher for the ecosystem and for us.

Human Health: The GMS is seeing hotter and more frequent heatwaves, which are a direct threat to our health. Warmer temperatures and less predictable rain patterns also raise the risk of diseases spread by water and insects, like malaria and dengue fever. These changes mean we need to be more vigilant about our health and find ways to adapt to these new climate realities, protecting ourselves and our communities from these growing threats.

Economic Development and Prosperity: The economy of the GMS is deeply connected to its natural environment and resources. Climate change poses a major threat, potentially leading to significant financial losses, especially in key areas like farming, fishing, and tourism. Infrastructure is also vulnerable to extreme weather, like storms and floods, which means there will need to be a big investment in strategies to adapt and protect these essential structures.

Social and Migration Issues: As climate change makes resources like water and arable land scarcer, people whose jobs depend on farming and fishing face increased hardships. This can lead to more social conflicts, forcing people to move to cities or even other countries in search of better living conditions. These migrations are challenging, not just for the individuals and families who move, but also for the communities that receive them, often leading to complex social issues.

Efforts to Address Climate Change Impacts

To tackle the effects of climate change, countries in the GMS are focusing on both mitigation strategies to cut down GHGs and adaptation methods to manage the changes that are already happening. These efforts include promoting sustainable agriculture practices, improving water management, protecting natural ecosystems, and strengthening disaster risk management. Regional cooperation is vital for these initiatives to be effective, especially when managing resources that cross national borders, like rivers and forests. Working together, GMS countries can share knowledge, resources, and strategies to better address the universal challenges posed by climate change. Additionally, there is a growing emphasis on innovative technologies such as renewable energy sources and smart infrastructure to further bolster resilience and sustainability in the region.

How Are the Countries of the GMS Adapting to Climate Change?

CAMBODIA

The Royal Government of Cambodia (RGC) is committed to combating climate change and accelerating the transition to a climate-resilient, low-carbon sustainable mode of development. The RGC has adopted a long-term carbon neutrality strategy that is designed to lead Cambodia to achieving net-zero emissions by 2050. The RGC has supported global efforts against climate change by being a Party to the United Nations Framework Convention on Climate Change (UNFCCC) since 1996. Cambodia has also joined the United Nations' Freshwater Challenge, a country-led initiative to support, integrate and accelerate the restoration of degraded rivers and wetlands, and conserve intact freshwater ecosystems. Some of the other most important initiatives that the country is taking are included below:

- **National Climate Change Strategic Plan**: Cambodia has developed a National Climate Change Strategic Plan to guide its climate change adaptation efforts. The plan focuses on building resilience in key sectors such as agriculture, water resources, and coastal areas.
- **Climate Resilient Agriculture:** Cambodia is promoting climate-resilient agriculture practices to help farmers adapt to changing climatic conditions. This includes the use of drought-resistant crops, improved water management, and sustainable land practices.
- **Community-Based Adaptation:** Cambodia is implementing community-based adaptation projects to help vulnerable communities adapt to climate change. These projects focus on building local capacity, improving infrastructure, and enhancing livelihoods.
- **Flood Management:** Cambodia is investing in flood management infrastructure, such as dykes and reservoirs, to reduce the impact of flooding on communities and agriculture.
- **Mangrove Conservation:** Cambodia is working to conserve and restore mangrove forests, which provide vital protection against coastal erosion and storm surges.
- **Capacity Building and Awareness:** Cambodia is building capacity among government agencies, local communities, and civil society organizations to better understand and respond to climate change. This includes raising awareness about climate change impacts and adaptation measures.

LAOS

Laos, like many countries in the Mekong region, is taking steps to adapt to climate change. In order to adapt to climate change the government, with help from civil society, is strengthening the capacity of the national disaster management committees and village forestry volunteers in forest planting, caring and management techniques as well as the use of village forests. Some of the key initiatives and actions include:

- **National Adaptation Program of Action to Climate Change**: Laos has developed a National Adaptation Plan (NAP) to address climate change impacts. The NAP focuses on building resilience in key sectors such as agriculture, water resources, and infrastructure.
- **National Strategy on Climate Change of Laos**: Presents the country's vision to the year 2050, and strategy and programs of actions to address climate change to the year 2030.
- **Climate-Resilient Agriculture:** Laos is promoting climate-resilient agricultural practices, such as crop diversification, soil conservation, and water management, to help farmers adapt to changing climatic conditions.
- **Ecosystem-Based Adaptation:** Laos is implementing ecosystem-based adaptation projects, such as reforestation and sustainable land management, to enhance ecosystem resilience and reduce vulnerability to climate change.
- **Community-Based Adaptation:** Laos is working to strengthen the capacity of local communities to adapt to climate change through community-based adaptation projects. These projects focus on building local knowledge and skills, improving infrastructure, and enhancing livelihoods.
- **Flood Management:** Laos is investing in flood management infrastructure, such as dykes and reservoirs, to reduce the impact of flooding on communities and agriculture.
- **Capacity Building and Awareness:** Laos is building capacity among government agencies, local communities, and civil society organizations to better understand and respond to climate change. This includes raising awareness about climate change impacts and adaptation measures.

MYANMAR

Myanmar is actively adapting to climate change by investing in climate-resilient infrastructure and revising agricultural practices to withstand variable weather patterns. There is also a focus on community-based adaptation strategies, which include extensive reforestation programs and the promotion of sustainable land management practices to reduce the adverse effects of climate change on vulnerable communities. Some of the key adaptation initiatives and actions include:

- **National Adaptation Plan**: Myanmar developed a National Adaptation Program of Action (NAPA) in 2012 to address climate change impacts. The NAPA focuses on building resilience in key sectors/themes such as agriculture, forests, water resources, and coastal areas.
- **Myanmar Climate Change Strategy 2018-2030**: The policy and strategy share the ambitious vision of transforming Myanmar into a climate-resilient, low-carbon society that is sustainable, prosperous and inclusive, for the well-being of present and future generations.
- **Climate-Resilient Agriculture:** Myanmar is promoting climate-resilient agricultural practices, such as crop diversification, soil conservation, and water management, to help farmers adapt to changing climatic conditions.
- **Ecosystem-Based Adaptation:** Myanmar is implementing ecosystem-based adaptation projects, such as reforestation and sustainable land management, to enhance ecosystem resilience and reduce vulnerability to climate change.
- **Community-Based Adaptation:** Myanmar is working to strengthen the capacity of local communities to adapt to climate change through community-based adaptation projects. These projects focus on building local knowledge and skills, improving infrastructure, and enhancing livelihoods.
- **Flood Management:** Myanmar is investing in flood management infrastructure, such as dykes and reservoirs, to reduce the impact of flooding on communities and agriculture.
- **Capacity Building and Awareness:** Myanmar is building capacity among authority groups, local communities, and civil society organizations to better understand and respond to climate change. This includes raising awareness about climate change impacts and adaptation measures.

THAILAND

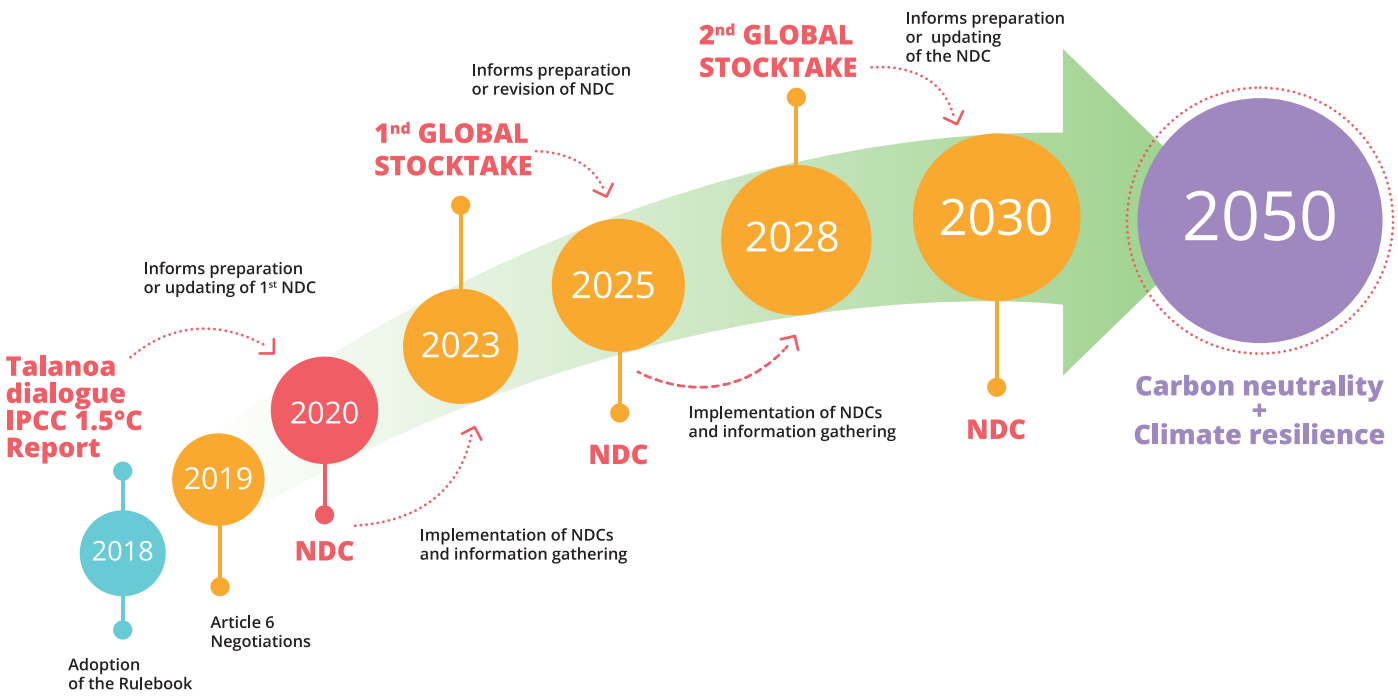
Thailand is addressing climate change through comprehensive adaptation strategies that include bolstering flood defenses and water management systems, especially in urban and agricultural areas prone to flooding. The country is also advancing its use of renewable energy sources and improving the resilience of its infrastructure to withstand extreme weather events. Some of the specific adaptation measures that Thailand is taking include:

- **Thailand's Climate Change Master Plan (CCMP)**: The national climate change master plan (2015-2050) is designed to help Thailand achieve sustainable low carbon growth and climate change resilience by 2050.
- **Water Management:** Thailand has improved its water management practices to cope with changing precipitation patterns and reduce the impacts of flooding and drought. This includes the construction of reservoirs, flood barriers, and drainage systems.
- **Agricultural Adaptation:** Thailand has promoted climate-resilient agricultural practices, such as the use of drought-resistant crops, improved irrigation systems, and soil conservation techniques. The government also provides support and incentives for farmers to adopt these practices.
- **Ecosystem Conservation:** Thailand has implemented measures to protect and restore its natural ecosystems, such as mangrove forests, which provide important coastal protection against storms and sea-level rise.
- **Urban Planning:** Thailand has incorporated climate change considerations into its urban planning processes to reduce the impacts of extreme weather events and heatwaves. This includes the development of green infrastructure and the promotion of sustainable building practices.
- **Community-Based Adaptation:** Thailand has supported community-based adaptation projects that enhance local resilience to climate change. These projects often involve building local capacity, improving livelihoods, and implementing small-scale infrastructure projects.
- **Policy and Planning:** Thailand has developed policies and plans to mainstream climate change adaptation across sectors. This includes the National Climate Change Master Plan and the National Adaptation Plan, which provide guidance for climate adaptation efforts at national and local levels.

International Agreements / Frameworks Related to Climate Change

- **United Nations Framework Convention on Climate Change (UNFCCC)**: An international treaty adopted in 1992 to address climate change and its impacts on a global scale. The treaty provides a framework for international cooperation to stabilize greenhouse gas concentrations in the atmosphere.
- **The Paris Agreement**: This agreement was adopted in 2015 at the United Nations Climate Conference (COP21) in Paris, France. It is an extension of the UNFCCC. It outlines a global effort to limit global warming to well below 2 degrees Celsius above pre-industrial levels, with an aspirational goal of limiting it to 1.5 degrees Celsius.
- **Nationally Determined Contributions (NDCs)**: A key component of the Paris Agreement, each country that is a party to the Paris Agreement is required to submit its own NDC outlining its climate action plans and commitments to address climate change including country-specific climate targets, mitigation goals, adaptation measures, and climate finance. Countries are required to regularly report on their progress in implementing and achieving their NDCs, facilitating a transparent and collective assessment of global efforts.
- **Cambodia's Updated Nationally Determined Contribution**. Cambodia submitted its updated first NDC in 2021. The updated NDC presents an emissions reduction target of 41.7% from the business-as-usual scenario by 2030, with half of that reduction concentrated in the forestry and land use sector and the rest primarily in the energy, agriculture, industry, and waste sectors.
- **Laos' Updated Nationally Determined Contribution**. The government of Laos submitted its first NDC in 2015 and first updated NDC in March 2021. The updated NDC has an unconditional emissions reduction target of 245 tCO2e and a conditional target of 415 mtCO2e by 2030.
- **Myanmar's Nationally Determined Contribution**. Myanmar submitted its updated first NDC in 2021. The updated NDC includes an unconditional emissions reduction target of 244.52 million tCO2e and a conditional target of 414.75 million tCO2e by 2030.
- **Thailand's Nationally Determined Contribution**. Thailand submitted its second NDC in 2022. It includes an unconditional emissions reduction target of 30% and a conditional target of 40% by 2030 as compared to the business-as-usual scenario. The second NDC covers the energy, industrial processes and product use, agriculture, and waste sectors.

Figure 8. The mechanisms and cycle of ambition of the Paris Agreement



Source: ECOWAS Commission Department of Agriculture, Environment and Natural Resources Guide to Implementation of the Paris Agreement for ECOWAS member states, 2020

Climate Change Environmental Education Activities

Learn more about the pressures on freshwater ecosystems as well as their role and value in how communities interact with, define themselves and understand the importance of freshwater.

Activity 2.1: Climate Change Witnesses
This activity involves you and your team going into the community to interview 5-10 senior residents to gather personal observations on climate change effects over time. After collecting these insights, you are asked to write an engaging story based on these collective interviews to share on a blog post or other online pr printed media channel.

Activity 2.2: Climate Change Mapping
To deepen your understanding of the complex cause and effect dynamics of global climate change, you are asked to create a system map that visualizes the connections between various factors linked with driving climate change as well as the system responses to climate change over time.

Activity 2.3: The Impacts of Climate Change
With this activity you will first create a mind map of climate change impacts for your country or community, then use this content to develop a comic strip that explores the impacts of climate change on your community in an engaging way.

Activity 2.4: Climate Change Action
In this activity, participants create a mind map to identify and focus on the top five personal actions you can take over the next year to help mitigate climate change.

Library for additional resources

Below are some additional online information resources available to you to dive deeper into this topic of climate change in the Mekong region.

- ASEAN State of Climate Change Report: Current status and outlook of the ASEAN region towards the ASEAN climate vision 2050
- ASEAN Multisectoral Framework for Climate Change
- An Assessment of the Nationally Determined Contributions (NDCs) of the States of Southeast Asia
- Climate Risk Country Profile: Cambodia (2021): The World Bank Group and the Asian Development Bank
- Climate Risk Country Profile: Laos (2021): The World Bank Group and the Asian Development Bank
- Climate Risk Country Profile: Thailand (2021): The World Bank Group and the Asian Development Bank
- UNICEF, Paris Agreement for Young People, provides an in-depth understanding of the Paris Agreement, its importance and all its articles in youth-friendly language
- UNICEF, Climate Glossary for Young People, is a glossary-style guide of the concepts and definitions that every climate activist, or budding climate activist, needs to know. Contains essential concepts on climate change, climate action, instruments and human rights
- UNICEF, What is Climate Governance, is a guide to help youth and young people better understand national climate governance and international climate negotiations
- United Nations. Mekong WET: Building Resilience of Wetlands in the Lower Mekong Region. Mekong WET: Building Resilience of Wetlands in the Lower Mekong Region - YouTube
- Stockholm Environment Institute (SEI), 2019, Development and Climate Change in the Mekong Region
- Open Development Mekong, 6 December 2017. Climate Change. opendevelopmentmekong.net/topics/climate-change/

C. Renewable Energy

Renewable energy comes from sources that naturally renew themselves, like sunlight, wind, rain, tides, waves, and geothermal heat. Unlike finite fossil fuels that emit GHGs that cause global warming and climate change, renewables offer cleaner alternatives like solar power from sunlight, wind power from air currents, hydroelectric power from water flow, bioenergy from organic materials, and geothermal energy from the Earth's heat. Using these technologies helps cut pollution, boosts energy security, and supports economic growth, providing a sustainable way to power our world.

The Picture of Renewable Energy in the GMS

Overall, the GMS countries are increasingly embracing renewable energy to meet their growing energy needs, reduce GHGs, and promote sustainable development. Already there is a significant and observable shift happening towards renewable energy in each of the countries of the region. This region, rich in rivers and sunlight, is tapping into its natural resources to shake up how it powers up. Countries like Thailand are big on solar energy, while Laos is using its rivers to produce hydroelectric power. Even Viet Nam is catching some serious wind energy vibes. This move is not just about keeping the lights on; it's about creating cleaner energy that doesn't mess up our planet. With renewable energy, GMS countries are not only aiming to keep their environment fresh but also boost their economies by being less dependent on expensive, imported fuels. It's a smart play towards a sustainable and self-sufficient future.

CAMBODIA

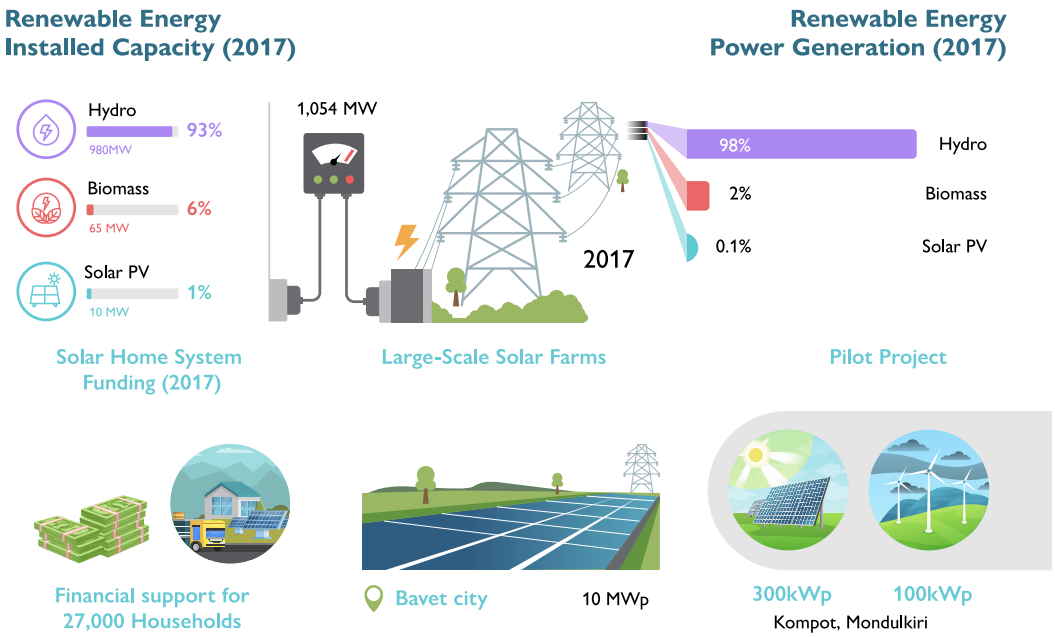


Figure 9. Cambodia renewable energy sources

Source: ASEAN – German Energy Programme (AGEP), 2020. Country Profiles.

Cambodia's Renewable Energy Scene: What's New and What's Next? In Cambodia, where electricity is pricey, renewable energy options like solar, wind, biofuel, and biogas are game changers. By 2020, every village was powered up, and by 2030, the plan is to have 70% of homes using grid-quality electricity. Thanks to its rich solar resources, Cambodia is on track to meet its power goals. Already, the government has set up over 36,000 solar systems in homes with a little help from international friends. There's also a huge 100 MW solar park in the works and a new 10 MW solar plant popping up in Bavet, Svay Rieng Province. These projects aren't just about more solar panels; they're also boosting the local grid with new technological capacity like energy storage, making sure Cambodia's power game is both modern and sustainable.

Wind energy in Cambodia faces challenges like low wind speeds and a delicate power grid, but there's hope. A successful pilot wind turbine project in Sihanoukville shows that wind power could work well in certain areas. To really get renewable energy off the ground, Cambodia needs to boost its technical skills, pass more green energy laws, and find more money to invest.

Some specifics on what Cambodia is doing…

Cambodia has been taking several measures to promote and scale up renewable energy in the country. Some of these initiatives include:

- **Policy Framework:** Cambodia has been developing and implementing policies to support renewable energy development. These include the Renewable Energy Law and the National Policy for Promotion of Renewable Energy for Sustainable Electricity Generation.
- **Investment Incentives:** The government has been offering various incentives to attract investment in renewable energy projects. These incentives may include tax breaks, subsidies, and other financial support mechanisms.
- **Renewable Energy Targets:** Cambodia has set renewable energy targets to increase the share of renewables in the country's energy mix. These targets provide a clear direction for the development of renewable energy infrastructure.
- **Hydropower Development:** While controversial due to environmental concerns, hydropower has been a significant focus in Cambodia's renewable energy development. Projects like the Lower Sesan II Dam have been built to harness hydropower.
- **Solar Energy Projects:** Cambodia has been increasingly investing in solar energy projects. This includes both large-scale solar farms and distributed solar systems, particularly in rural areas.
- **Wind Energy Potential:** Cambodia has also been exploring its potential for wind energy generation. Studies and assessments have been conducted to identify suitable areas for wind farm development.
- **International Cooperation:** Cambodia has been collaborating with international organizations and development partners to support its renewable energy efforts. This collaboration involves knowledge sharing, technology transfer, and financial assistance.
- **Capacity Building:** Efforts have been made to build local capacity in renewable energy technologies and project management. This includes training programs, workshops, and educational initiatives to equip local professionals with the skills needed for the renewable energy sector.

Find out more about Cambodia's energy information including national policy and activities here.

LAOS

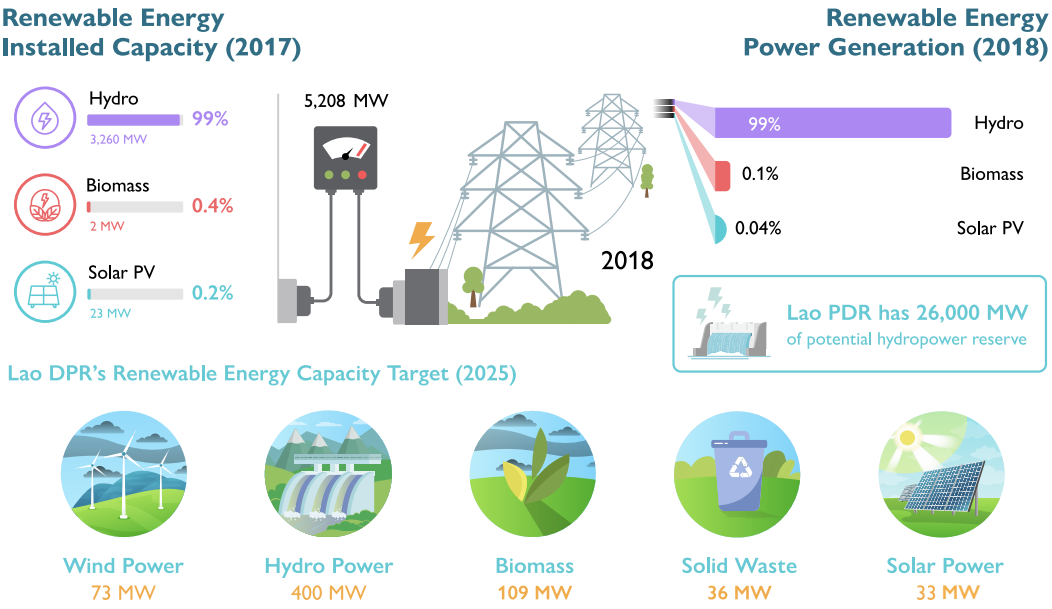


Figure 10. Laos renewable energy sources

Source: ASEAN – German Energy Programme (AGEP), 2020. Country Profiles.

Laos' Renewable Energy Scene: What's New and What's Next? The Lao government is aiming to shake up the renewable energy scene by fulfilling 30% of the country's energy needs with renewables by 2025. Mini-hydropower plants will be the focus, but solar, wind, biomass, and biogas aren't far behind. Around 20,000 solar systems are already powering homes, and they've even kicked off hybrid solar-mini hydropower systems in rural areas. But here's the hitch—many rural spots are still off the grid, making it tough to set up big solar and wind projects. For those in off-grid areas, tapping into small-scale solar or wind energy is an option, though it might be a bit pricey.

Laos is gearing up for a cross-border power project that blends traditional grid systems with innovative off-grid solutions like battery storage and mini-grids powered by renewables. Thanks to its significant solar potential and dropping prices in renewable tech, especially solar photovoltaics, Laos sees off-grid renewable energy as a viable option in electrifying its rural areas. This move is part of a bigger push to boost renewable energy use and hit sustainable development goals.

Some specifics on what Laos is doing …

The Laos government has been taking several measures to promote and scale up renewable energy in the country. Some measures include:

- **Hydropower Development:** Several large-scale hydropower projects have been developed, and more are planned for the future. However, there have been environmental and social concerns associated with some of these projects, leading to increased scrutiny and efforts to address these issues sustainably.
- **Solar Energy Projects:** Laos has been increasingly investing in solar energy projects, particularly for off-grid electrification in rural areas where extending the national grid may not be feasible. Notably, the introduction of solar home systems has been a key strategy, supported by international collaborations and funding mechanisms aimed at enhancing rural electrification.
- **Wind Energy Potential:** The country has also been exploring its potential for wind energy generation over the past decade. Studies and assessments have been conducted to identify suitable areas for wind farm development, with the Monsoon Wind Power Project already operational in the southern provinces of Sekong and Attapeu.
- **Policy Framework:** Laos has developed policies and regulations to support renewable energy development. These include the Renewable Energy Development Strategy, which aims to promote the use of renewable energy and increase its share in the country's energy mix.
- **Investment Incentives:** The government offers various incentives to attract investment in renewable energy projects, including tax breaks, subsidies, and other financial support mechanisms.
- **International Cooperation:** The Laos government is collaborating with international organizations, development partners, and neighboring countries to support its renewable energy efforts. This collaboration involves knowledge sharing, technology transfer, and financial assistance.
- **Capacity Building:** Efforts have been made to build local capacity in renewable energy technologies, project management, and policy implementation. This includes training programs, workshops, and educational initiatives to equip local professionals with the skills needed for the renewable energy sector.
- **Grid Expansion and Interconnection:** Laos is also working on expanding its national grid and enhancing regional grid interconnections to facilitate the integration of renewable energy sources into the power system and promote regional energy trade.

Find out more about Laos' energy information including national policy and activities here.

MYANMAR

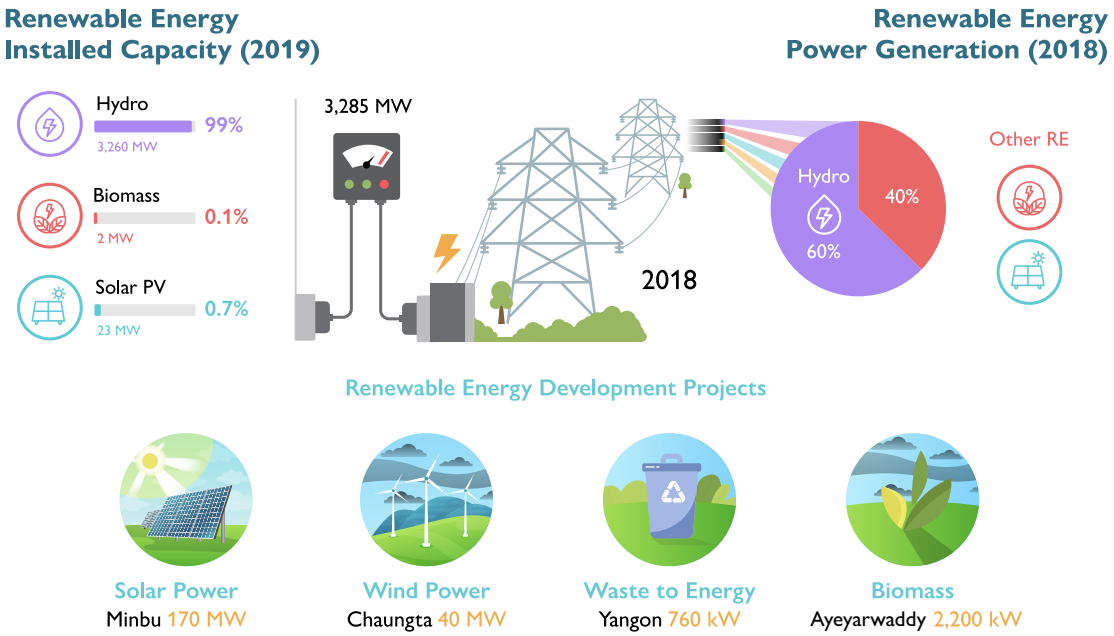


Figure 11. Myanmar renewable energy sources

Source: ASEAN – German Energy Programme (AGEP), 2020. Country Profiles.

Myanmar's Renewable Energy Scene: What's New and What's Next? The development of the country's solar, wind, and biomass energy potential has lagged behind hydropower. Even though many parts of Myanmar get a lot of sunlight, the mountainous terrain, protected areas, and the limited size of the electrical grid make it tough to tap into this potential on a large scale. Right now, the country uses smaller solar solutions like battery charging stations, solar lights, and village mini-grids, but hasn't built any big solar power plants yet. Back in 2014, Myanmar set out a renewable energy policy under its Rural Electrification Plan, aiming to generate significant wind and solar power—6,500 MW from wind and 1,500 MW from solar.

Some Specifics on What Myanmar is doing …

Myanmar has been taking several measures to promote and scale up renewable energy in the country. Some of these initiatives include:

- **Policy Framework:** Myanmar has been developing policies and regulations to support renewable energy development. These include the National Electrification Plan (NEP) and the National Renewable Energy Policy (NREP), which aim to promote the use of renewable energy and increase its share in the country's energy mix.
- **Investment Incentives:** Incentives have been offered to attract investment in renewable energy projects. These incentives may include tax breaks, subsidies, and other financial support mechanisms to encourage both domestic and foreign investment.
- **Hydropower Development:** Myanmar has abundant hydropower potential, and hydropower has historically been the dominant renewable energy source in the country. However, there are environmental and social concerns associated with large-scale hydropower projects, leading to increased scrutiny and efforts to ensure sustainable development.
- **Solar Energy Projects:** Myanmar has been increasingly investing in solar energy projects, particularly for off-grid electrification in rural areas. These projects include standalone solar systems, solar mini-grids, and utility-scale solar farms.
- **Wind Energy Potential:** The country also has significant wind energy potential, particularly in coastal and mountainous regions. While wind energy is not as widely utilized as hydropower and solar energy currently, there has been growing interest in exploring and harnessing this resource.
- **Grid Expansion and Interconnection:** Myanmar is working on expanding its national grid and enhancing regional grid interconnections to facilitate the integration of renewable energy sources into the power system and promote regional energy trade.
- **Capacity Building:** Efforts have been made to build local capacity in renewable energy technologies, project management, and policy implementation. This includes training programs, workshops, and educational initiatives to equip local professionals with the skills needed for the renewable energy sector.
- **International Cooperation:** Myanmar collaborates with international organizations, development partners, and neighboring countries to support its renewable energy efforts. This collaboration involves knowledge sharing, technology transfer, and financial assistance.

Find out more about Myanmar's energy information including national policy and activities here.

THAILAND

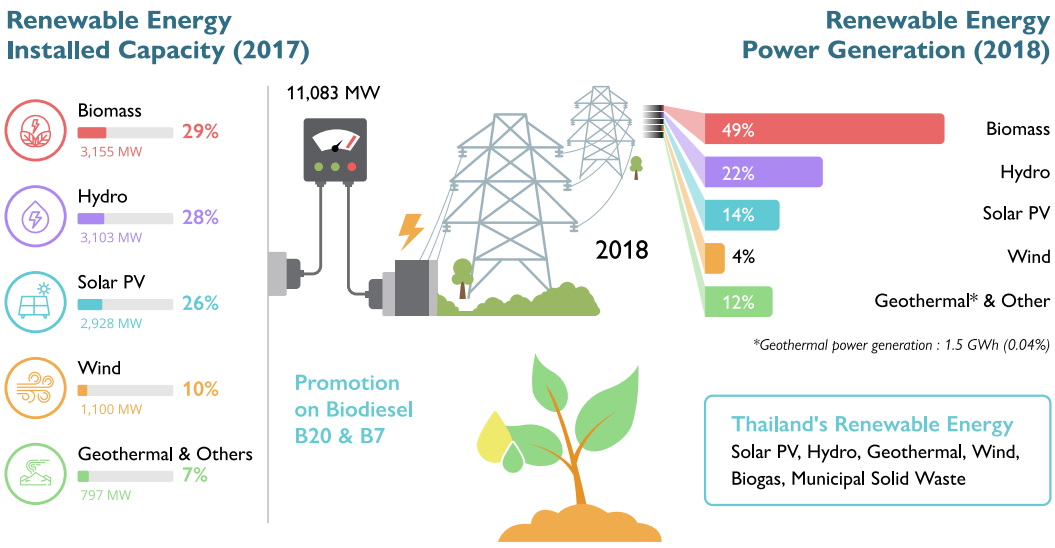


Figure 12. Thailand renewable energy sources

Source: ASEAN – German Energy Programme (AGEP), 2020. Country Profiles.

Thailand's Renewable Energy Scene: What's New and What's Next? Thailand's energy policy is focused on reducing GHGs and cutting down on imported energy by boosting renewable energy use. By 2021, Thailand aims to increase its renewable energy usage by 25%, which includes ramping up mini-hydropower, doubling biomass energy production, and expanding solar and wind power capacities. As of 2016, Thailand installed 2,142 MW of solar energy. Back in 2014, its wind energy capacity was 224 MW. From 2010 to 2014, the share of renewable energy in electricity production jumped from 5.9% to 9.9%, showing significant growth in this area.

Some specifics on what Thailand is doing ...

Thailand has been actively promoting and scaling up renewable energy as part of its energy security and sustainability goals. Some key initiatives and strategies include:

- **Renewable Energy Development Plans:** Thailand has established renewable energy development plans, including the Alternative Energy Development Plan (AEDP) and the Power Development Plan (PDP). These plans set targets and provide a roadmap for increasing the share of renewable energy in the country's energy mix.
- **Feed-in Tariff (FiT) and Renewable Energy Auctions:** Thailand has implemented feed-in tariff schemes and renewable energy auctions to incentivize investment in renewable energy projects. These mechanisms provide guaranteed payments for electricity generated from renewable sources and help attract private investment.
- **Solar Energy:** Thailand has made significant investments in solar energy, both utility-scale solar farms and rooftop solar installations. The country has favorable solar irradiation levels, making it well-suited for solar power generation. Government incentives, including FiT schemes and net metering programs, have contributed to the growth of the solar energy sector.
- **Wind Energy:** Thailand is also developing its wind energy potential, particularly in the southern and northeastern regions. Wind farms are being established, and the government has introduced policies to support wind power development, such as FiT schemes and competitive bidding processes.
- **Bioenergy:** Thailand has been utilizing biomass, biogas, and waste-to-energy technologies to generate electricity. The country has abundant agricultural and forestry residues that can be used as feedstock for bioenergy production. Incentives and policies to promote bioenergy projects have been implemented to diversify the energy mix and reduce GHGs.
- **Hydropower:** While hydropower has been an important part of Thailand's energy mix for many years, there has been increasing awareness of environmental and social impacts associated with large dams. As a result, there has been more emphasis on small-scale hydropower and run-of-river projects that have less significant environmental footprints.
- **Energy Storage and Grid Integration:** Thailand is exploring energy storage technologies to enhance the integration of renewable energy into the grid. Battery storage systems and other forms of energy storage can help address intermittency issues associated with renewable energy sources and improve grid stability.
- **Research and Development:** The Thai government, along with research institutions and private companies, is investing in research and development initiatives to advance renewable energy technologies, improve efficiency, and reduce costs.

Find out more about Thailand's energy information including national policy and activities here.

Renewable Energy Environmental Education Activities

Activity 3.1: Energy Quiz
Kick off your exploration of renewable energy with this engaging warm-up quiz! Test your knowledge on various renewable energy sources and see how much you know about the current status of energy powering your own country

Activity 3.2: Renewable vs Non-Renewable Energy
Sometimes whether an energy source is truly renewable or nonrenewable is not well understood. By extension, the advantages and disadvantages to development for a country selecting which type of energy source to exploit or use can also be complex or confused. This activity will guide you through these questions, so that you will have a clearer understanding of the overall energy picture.

Activity 3.3: Renewable Energy Alternatives
This activity tasks you with searching out news articles about various forms of renewable energy used in your own country, and analyzing their application, impact, and suitability for local community needs to better understand their potential benefits and challenges for investment and long-term use.

Library for additional resources

Below are some additional online information resources available for you to dive deeper into the topic of renewable energy in the Mekong region.

- Renewable Energy Developments and Potential in the Greater Mekong Subregion (adb.org)
- UNICEF's A young person's guide to sustainable energy provides a simple summary of key concepts to understand sustainable energy and its relationship with climate change, the role of young people, and why the world needs a just energy transition.
- Channel News Asia, 4 April 2024. Southeast Asia needs to accelerate development of capacities for renewable energy: Study (youtube.com)
- DW News, 2011. Renewable energy in Cambodia | Global Ideas. Renewable energy in Cambodia | Global Ideas (youtube.com)
- APAC Network, 12 September 2022. Laos' new energy agenda. Laos' new energy agenda (youtube.com)

Key GMS Institutions, Agreements and Frameworks related to Freshwater Ecosystem Management, Climate Change and Renewable Energy

The GMS has several key institutions, agreements, and treaties regarding river and wetland management. The most important include:

- **1995 Mekong Agreement:** The Mekong Agreement established the legal framework for cooperation among the riparian countries for the sustainable development of the Mekong River Basin. It provides principles for water utilization, resource management, and cooperation in various sectors, including hydropower, agriculture, fisheries, and environmental protection.
- **Mekong River Commission (MRC):** The MRC is an intergovernmental river basin organization that facilitates cooperation among the riparian countries of the Mekong River–Cambodia, Laos, Thailand, and Viet Nam. It facilitates cooperation among the riparian countries for sustainable development of the Mekong River Basin. The MRC implements various programs and projects related to water resource management, hydropower development, fisheries, and environmental protection. The MRC operates under the 1995 Mekong Agreement.
- **Mekong-Lancang Cooperation (MLC):** The Mekong-Lancang Cooperation is a framework initiated by PRC in 2015 to enhance regional cooperation and connectivity. The member countries include PRC, Cambodia, Laos, Myanmar, Thailand, and Viet Nam. MLC focuses on various areas, including water resources, connectivity, production capacity, cross-border economic cooperation, and sustainable development.
- **Mekong River Basin Development Strategy and Action Plan:** This strategy and action plan, developed by the MRC, provides a framework for addressing key challenges in the Mekong River Basin, including water resource management, climate change adaptation, and sustainable development. It guides the implementation of projects and initiatives to achieve sustainable development goals in the basin.
- **Sustainable Hydropower Development Strategy:** The MRC member countries have developed a Sustainable Hydropower Development Strategy to guide the planning and management of hydropower projects in the Mekong River Basin. The strategy aims to balance the economic benefits of hydropower development with environmental and social considerations.
- **GMS Environment Operations Center (EOC):** The GMS EOC facilitates regional cooperation and coordination on environmental issues, including those related to rivers and wetlands. It supports the implementation of the GMS Strategic Framework and Action Plan for Environmental Management and Biodiversity Conservation.
- **Greater Mekong Subregion Strategic Framework:** The GMS Strategic Framework provides a framework for addressing key challenges in the Mekong River Basin, including water resource management, climate change adaptation, and sustainable development.
- **ASEAN Agreements and Initiatives:** The Association of Southeast Asian Nations (ASEAN) has various agreements and initiatives related to water resource management and environmental conservation in the GMS. These agreements often complement efforts at the national and regional levels.
    - **ASEAN Agreement on Transboundary Haze Pollution (AATHP):** The AATHP agreement aims to address the issue of transboundary haze pollution, which is often caused by forest fires and land-clearing activities, particularly in Southeast Asia. It promotes cooperation among ASEAN member states to prevent and mitigate haze pollution.
    - **ASEAN Working Group on Climate Change (AWGCC):** The AWGCC coordinates ASEAN's efforts on climate change adaptation and mitigation. It facilitates information exchange, capacity building, and cooperation among ASEAN member states on climate-related issues.
    - **ASEAN Climate Change Initiative (ACCI):** The ACCI focuses on enhancing ASEAN's capacity to address climate change challenges through various activities, including research, policy development, and implementation of climate change adaptation and mitigation measures.
    - **ASEAN Plan of Action for Energy Cooperation (APAEC):** The ASEAN Plan of Action for Energy Cooperation is a framework that outlines the strategic goals and actions for energy cooperation within the ASEAN region. Mekong countries such as Cambodia, Laos, Myanmar, Thailand, and Viet Nam, being members of ASEAN, are involved in initiatives to promote renewable energy and enhance energy security.
    - **ASEAN Climate Change and Energy Project (ACCEPT):** The ASEAN Climate Change and Energy Project (ACCEPT) is a comprehensive initiative aimed at enhancing the coherence between ASEAN's energy and climate policies to foster a more climate-friendly development of the energy sector. This project is a collaborative effort between the ASEAN Centre for Energy (ACE) and the Norwegian Institute of International Affairs (NUPI), funded by the Norwegian Government under the Norwegian-ASEAN Regional Integration Program (NARIP).
- **Convention on Biological Diversity:** The Convention on Biological Diversity (CBD) is the first global agreement to cover all aspects of biological diversity. The CBD has three main objectives: the conservation of biological diversity; the sustainable use of the components of biological diversity; and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources.
- **Ramsar Convention**: Several wetlands in the GMS are designated as Ramsar sites under the Ramsar Convention on Wetlands. This international treaty aims to conserve and sustainably use wetlands and their resources. These sites play crucial roles in maintaining biodiversity, supporting livelihoods, and regulating water flow within the region. Ramsar Convention Wetland sites in the GMS can be found below:
    - List of Ramsar wetlands of Cambodia
    - List of Ramsar wetlands of Laos
    - List of Ramsar wetlands of Myanmar
    - List of Ramsar wetlands of Thailand
    - List of Ramsar wetlands of Viet Nam

Cross-Cutting Environmental Education Activities

Activity 4.1: What am I drinking, what are the impacts, and what change can I make or influence?
This activity will provide some deeper insights into the environmental, social and economic impacts of an average person's daily routine. Following the activity's sequence of steps will also provide deeper thinking on what one can do to make and influence positive change through one's personal decisions and actions.

Activity 4.2: Pieces, Patterns and Processes (PPP)
By following this activity, you and your team will explore your community through observation, interviews, map-making, and hands-on experiences to answer some key questions about their relations with the topic you are investigating. PPP will provide a good opportunity to uncover some critical insights about your community interrelations with the Mekong environment and interconnectedness between the three aspects of sustainable development (environment, society and economy).

Activity 4.3: Compass Mapping a Thematic Issue
The Compass Mapping exercise will help you to examine one of the three thematic issues through a 360° sustainability lens. This approach will enable you to have a clearer understanding of the causes and effects of the issues, empowering you to identify effective solutions.

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.

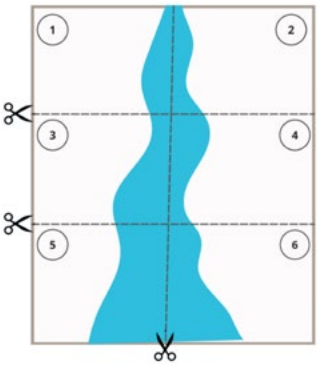
BACKGROUND INFORMATION

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.

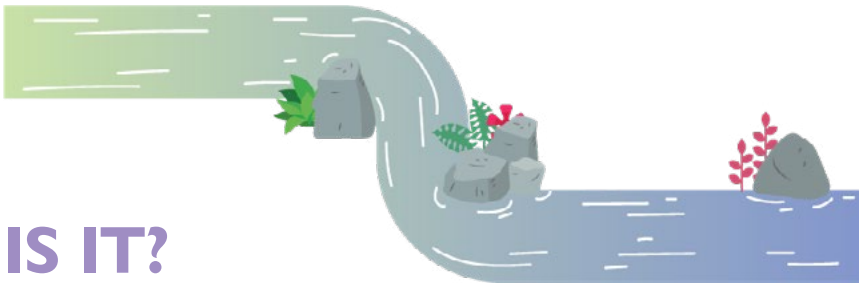
Variations

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

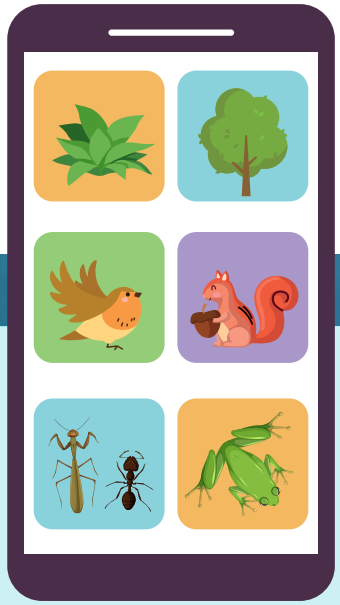
Water insects

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.

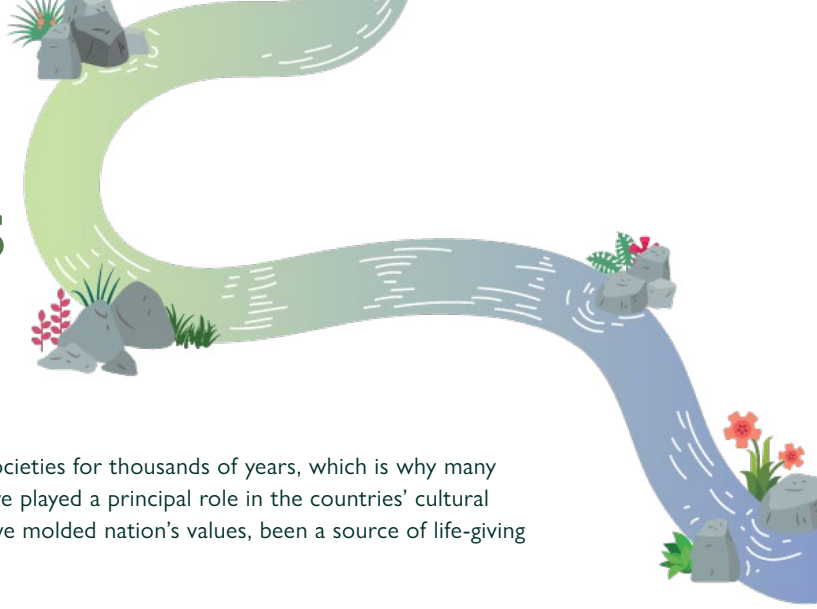
FRESHWATER ECOSYSTEM HEALTH REPORT

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

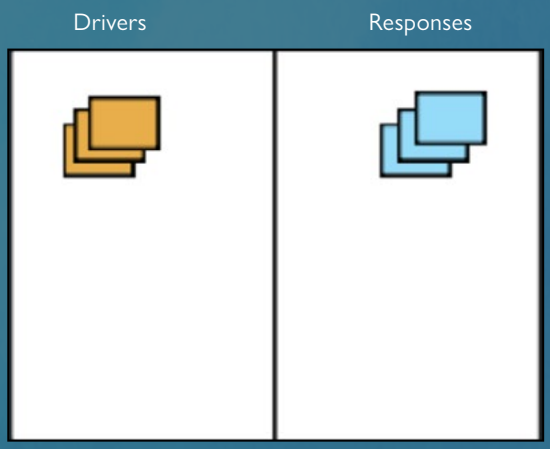
Materials:

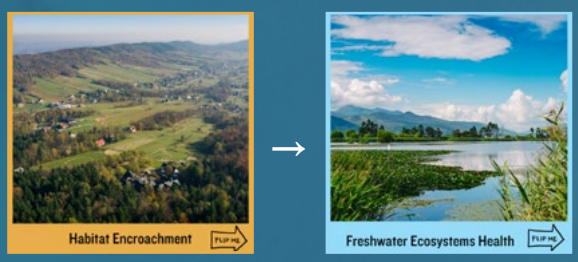
1. **Print out the provided visual elements on A4-size paper, double-sided, and proceed to cut them into individual pieces. Sort them out by color (border color).**
    - The card set contains 2 different colors of cards. Yellow represents the drivers and pressures of the freshwater ecosystem health 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.





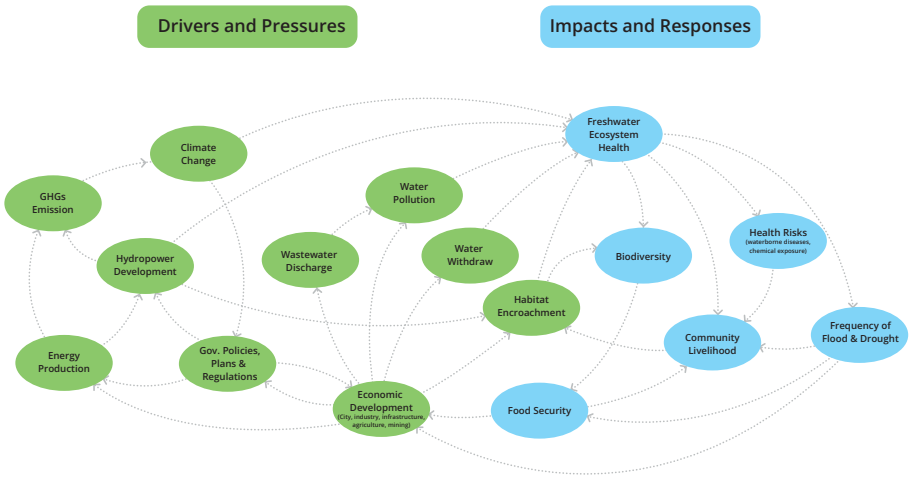
6. Continue to identify the cause-effect linkages between different elements and draw directional arrows to indicates their causal relationships. If you think some elements are missing from this set of cards or, if you would like to add more details, please write down the additional elements on the blank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

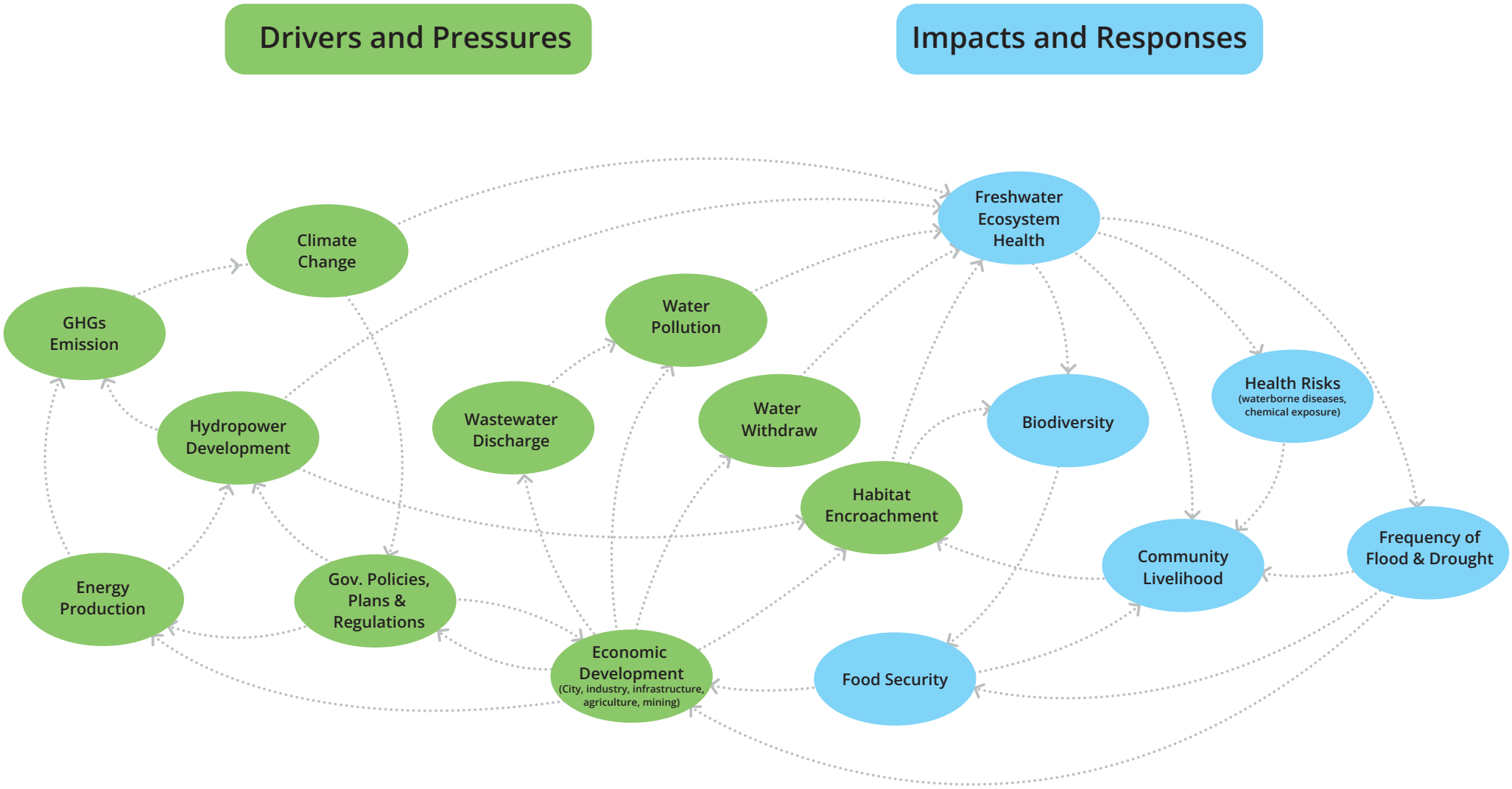
FRESHWATER ECOSYSTEM HEALTH DIAGRAMMING ANALYSIS AND DEBRIEF QUESTIONS

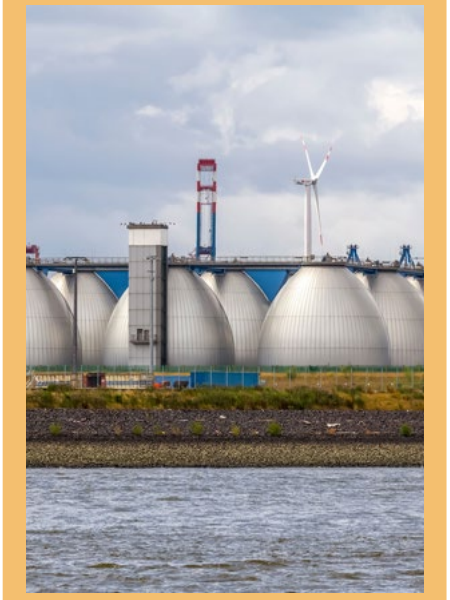
After you finish working on the map, try to go through each of these questions below to generate deep thinking and discussion among the team.

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





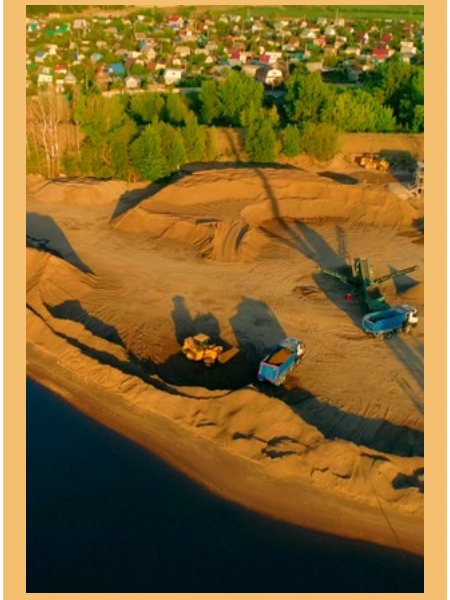
Water Withdraw

Flip me →

Economic Development

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

Flip me →

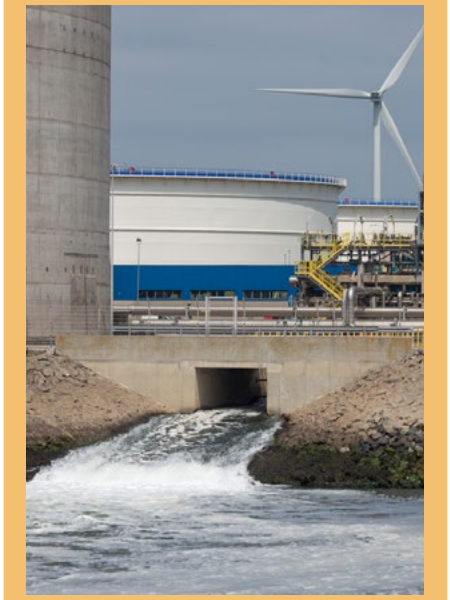


Habitat Encroachment

Flip me →

Water Pollution

Flip me →

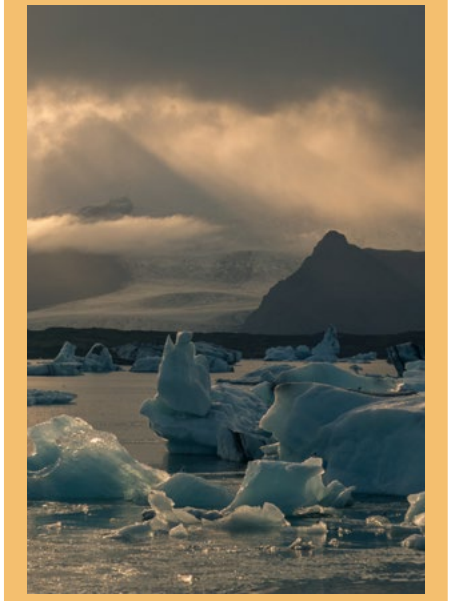


Wastewater Discharge

Flip me →

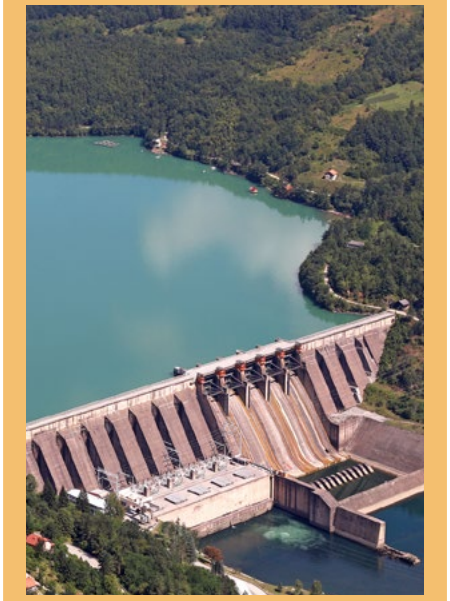
Government Policies, Planning and Regulations

Flip me →



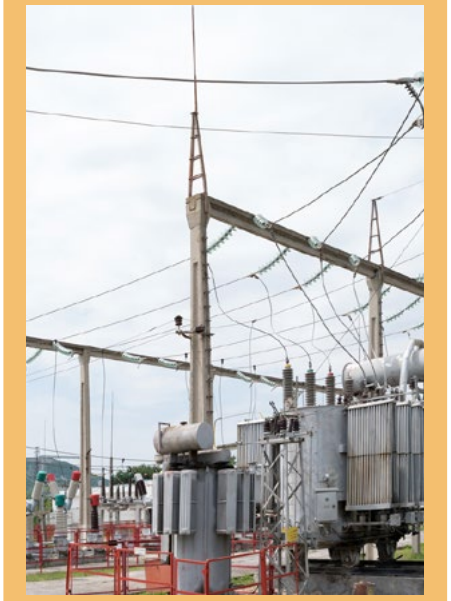
Climate Change

Flip me →



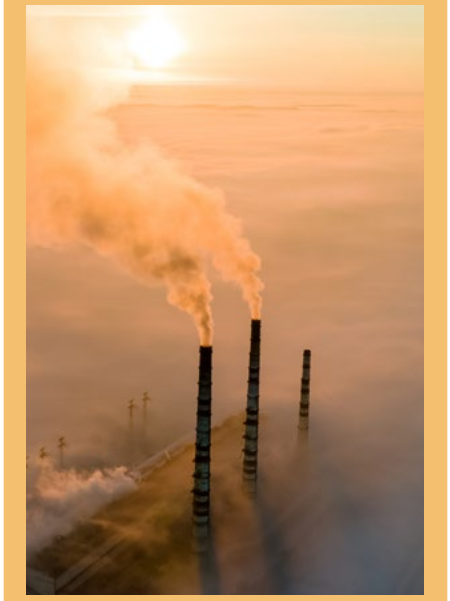
Hydropower Development

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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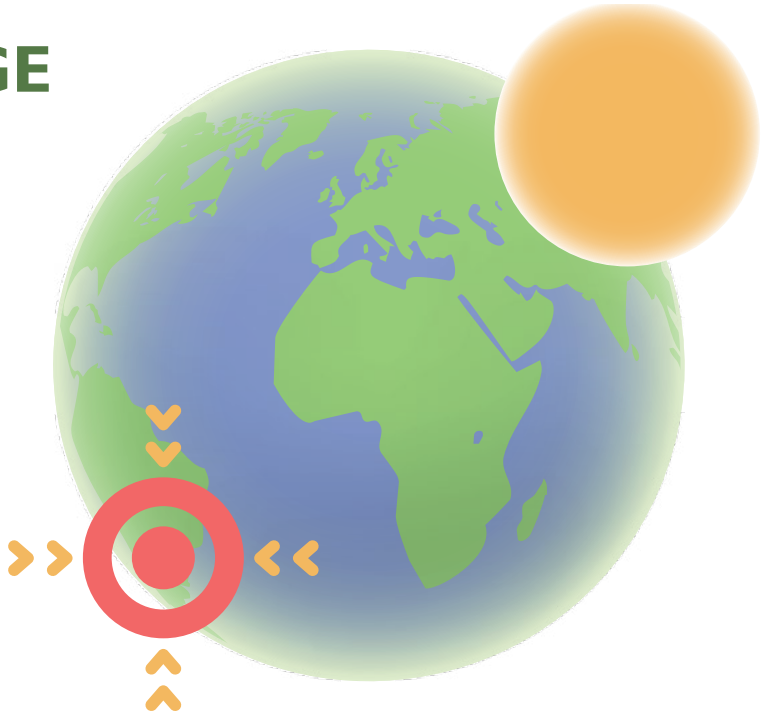
1.2.1

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.

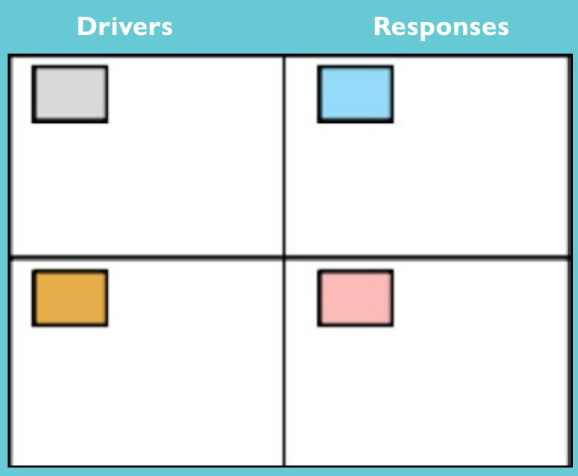
Time Required: 45-60 minutes

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.

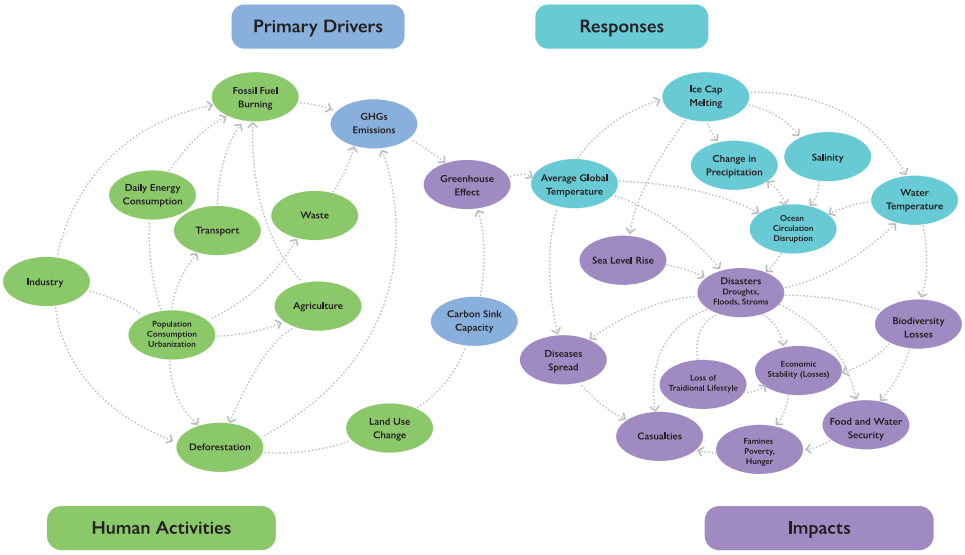
6. Continue to identify the cause-effect linkages between different elements and draw directional arrows to indicates their causal relationships. If you think some elements are missing from this set of cards or, if you would like to add more details, please write down the additional elements on the blank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

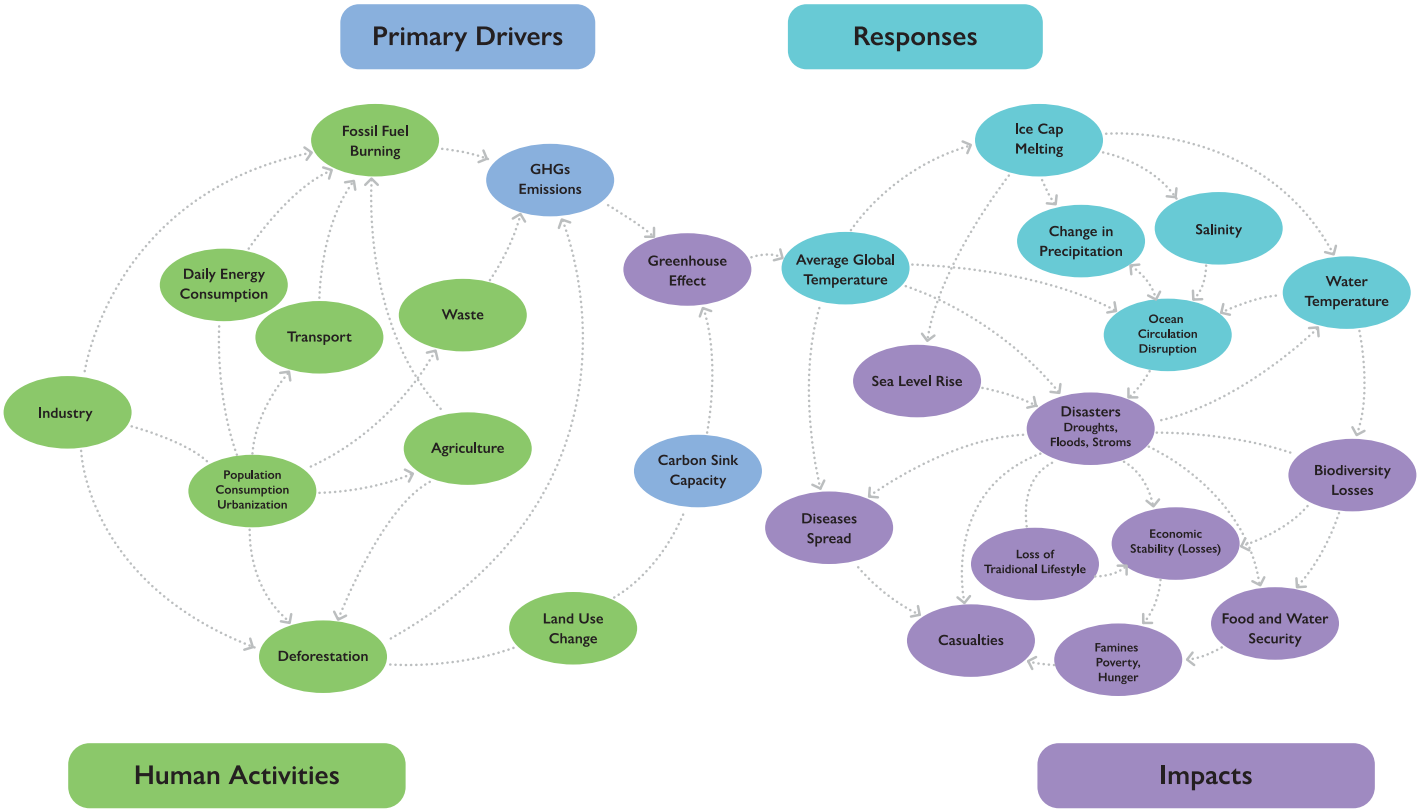


CLIMATE DIAGRAMMING ANALYSIS AND DEBRIEF QUESTIONS

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

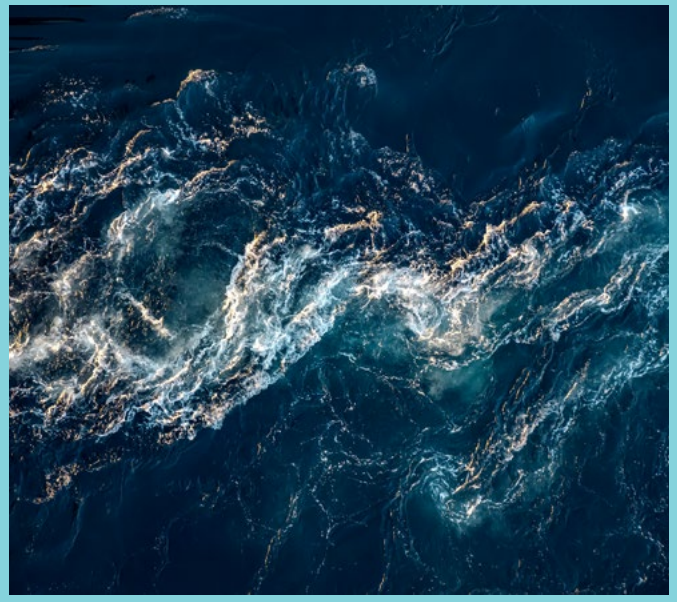
Flip me →

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

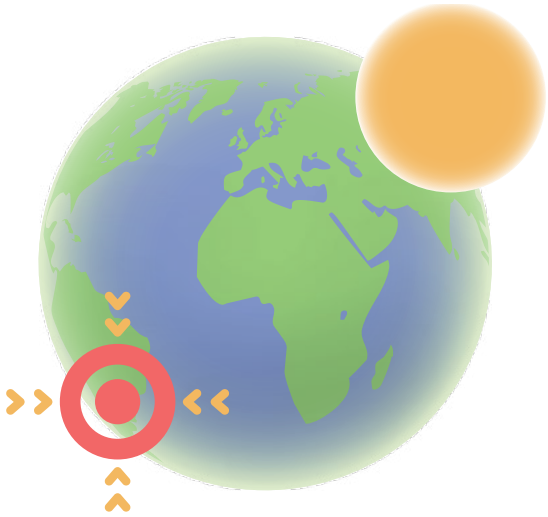
The decline in **biodiversity** undermines agricultural productivity and **food security**, as diverse ecosystems contribute to pollination, soil fertility, and natural pest control.

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.

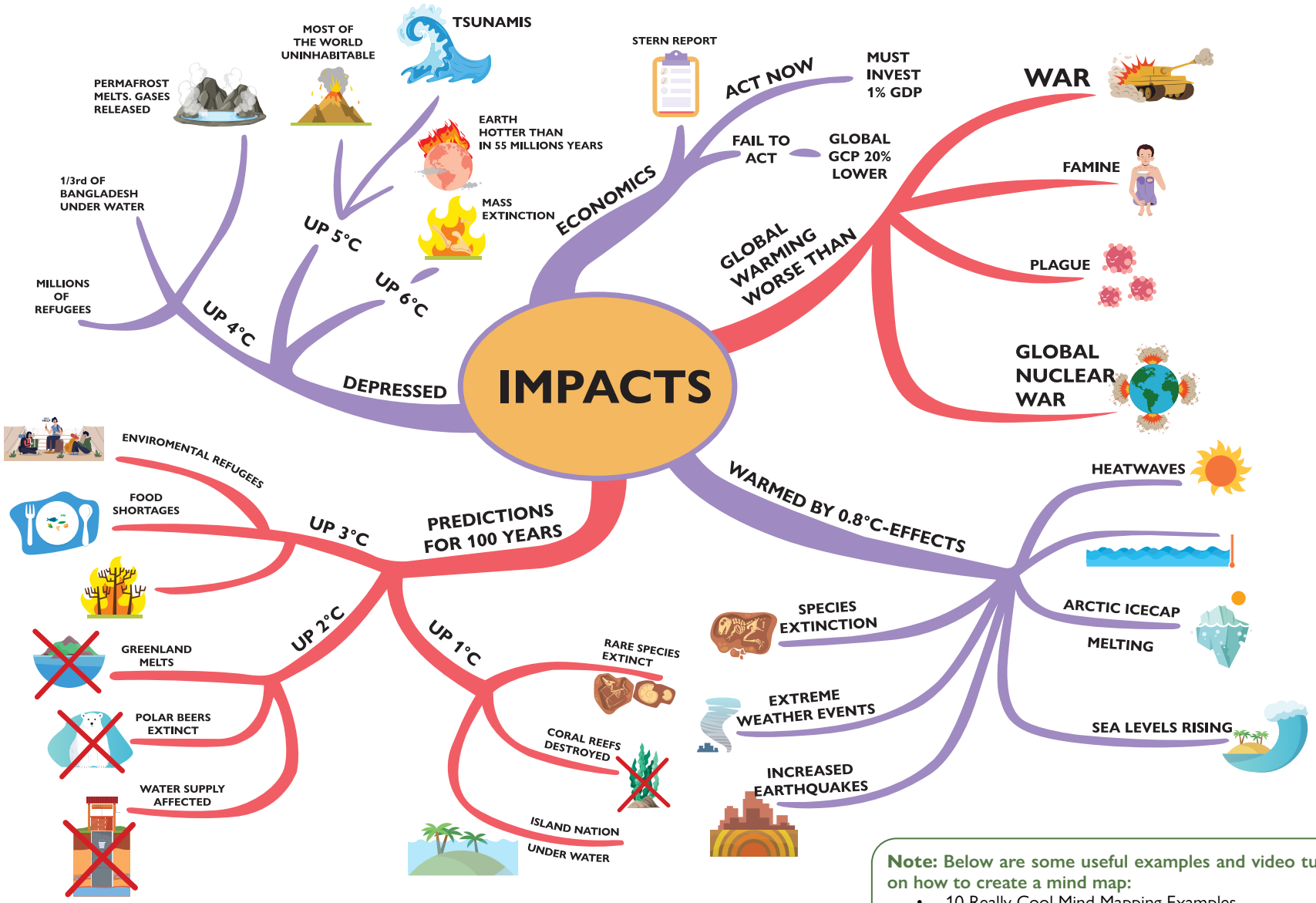
YOUR ASSIGNMENT

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...



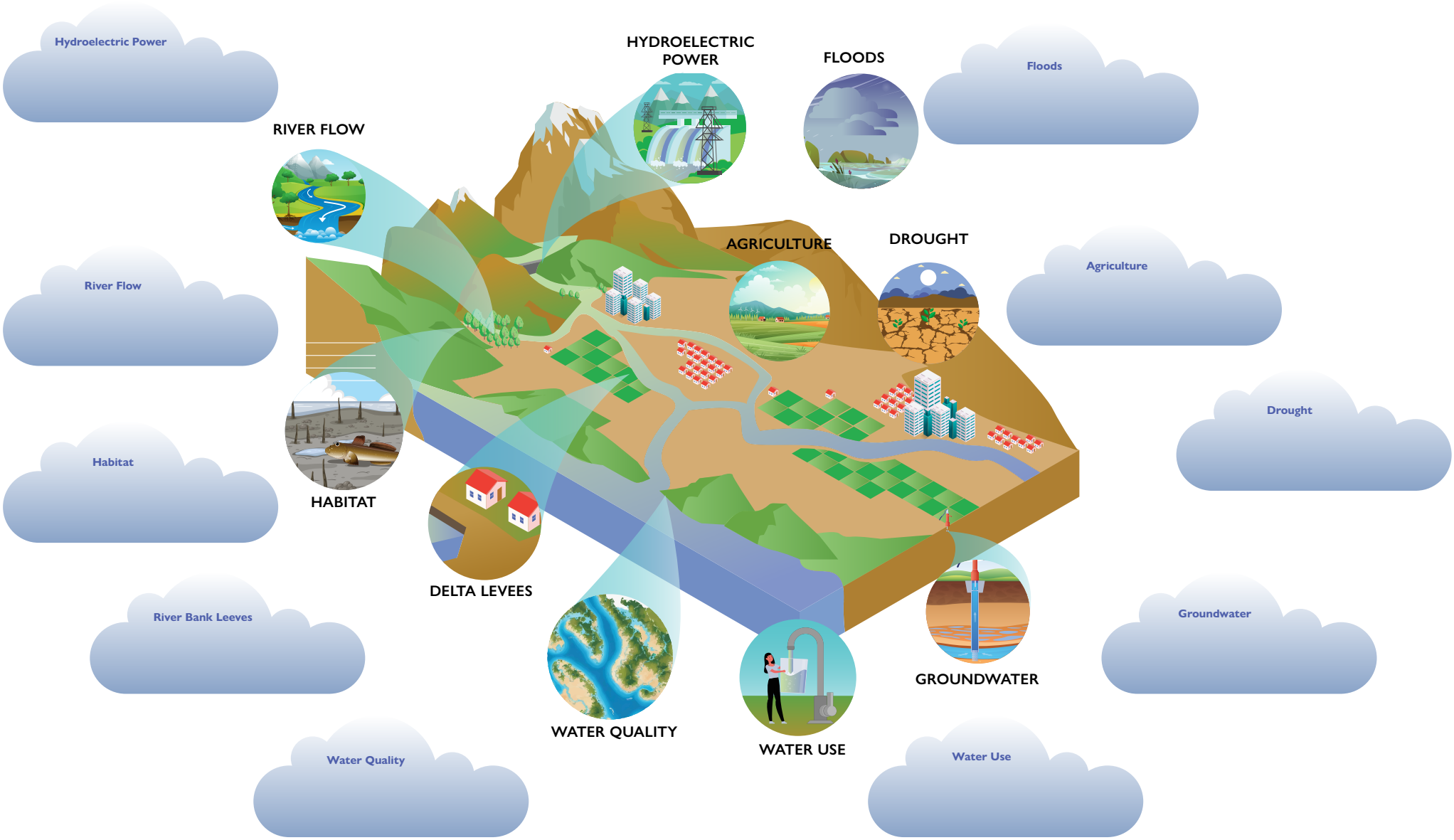
Note: Below are some useful examples and video tutorials on how to create a mind map:

- 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.

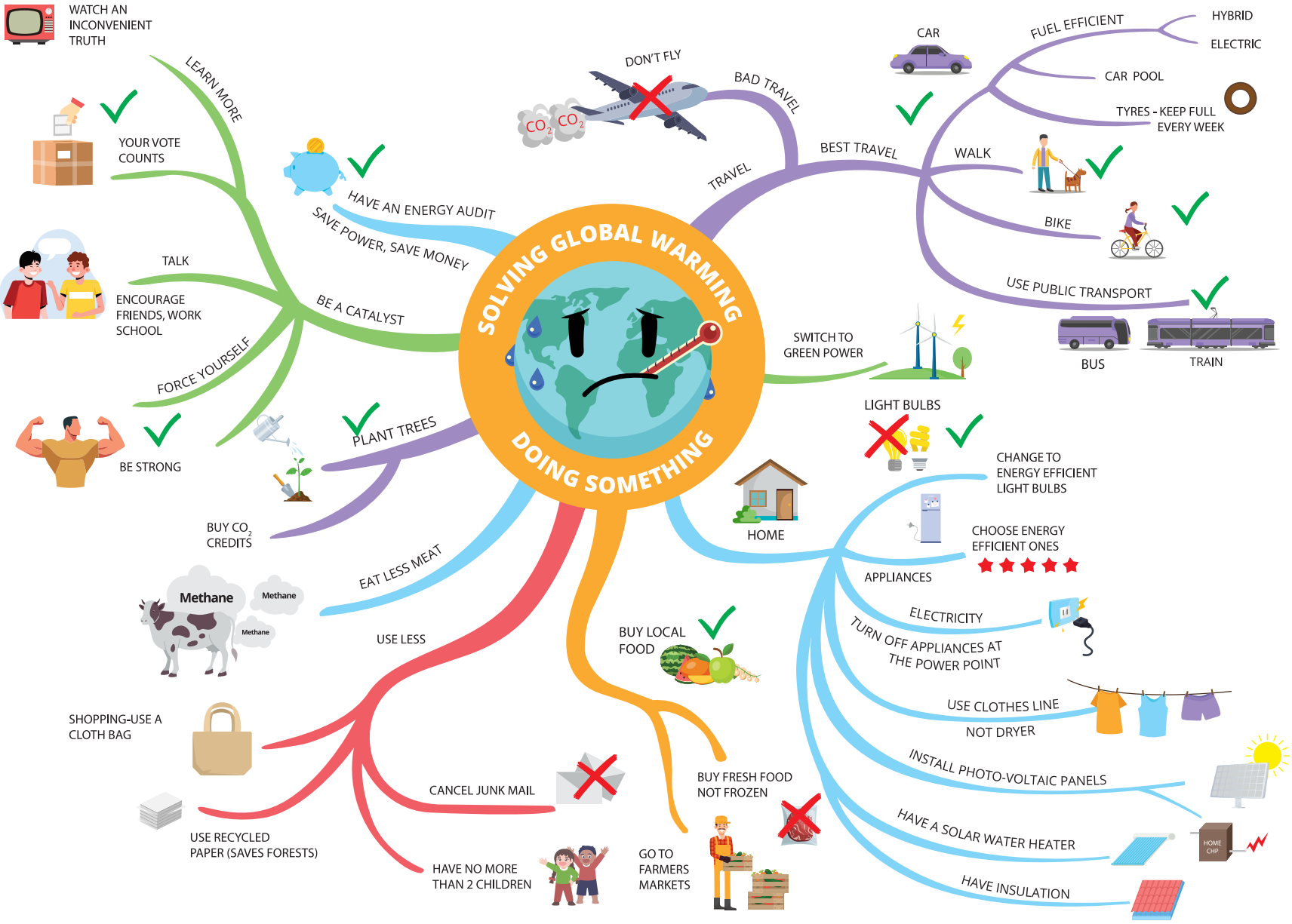
Creating a mind map is quite simple, just follow the simple steps described here...

- 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

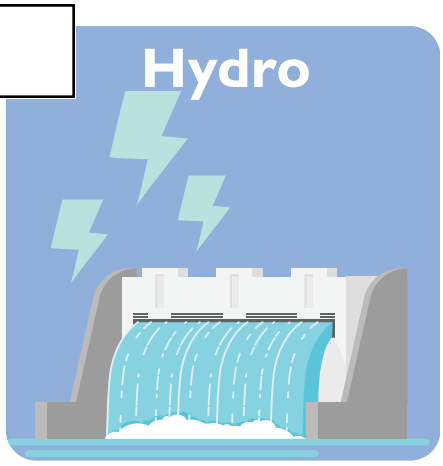
Electric power can be generated from various types of fuel sources.

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

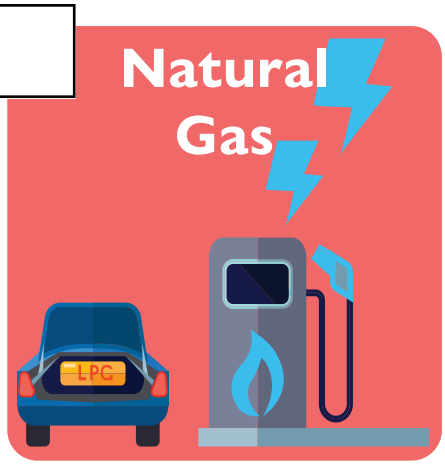
- Highest share = 1
- Lower shares = 2, 3, 4, etc.

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

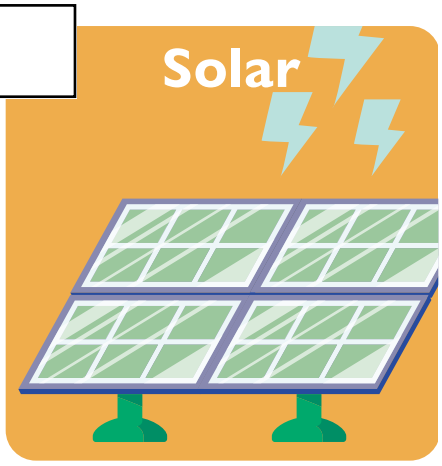
☐ Hydro



☐ Natural Gas

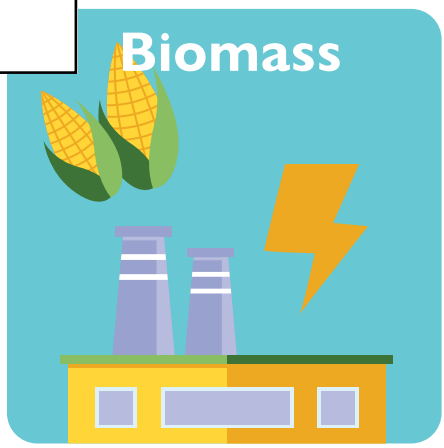


☐ Solar

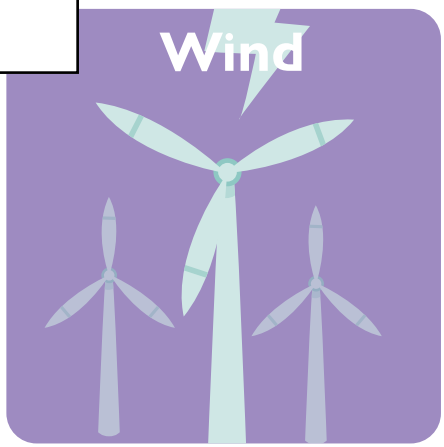


☐ Coal

☐ Biomass



☐ Wind

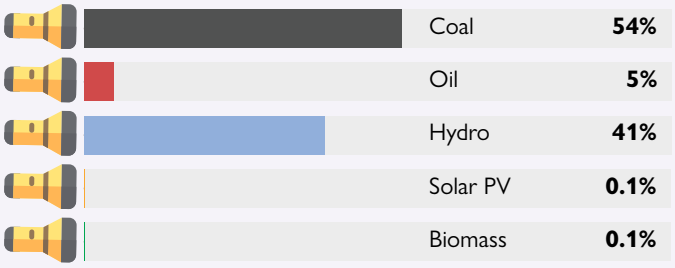


☐ Other Renewable Energy

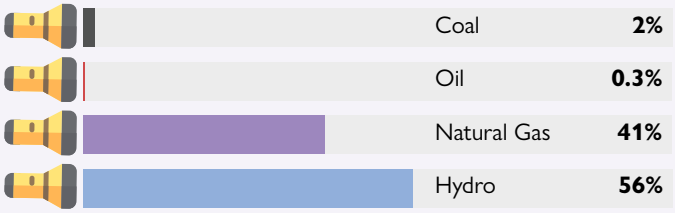
Check your answers →

POWER GENERATION
BY COUNTRY

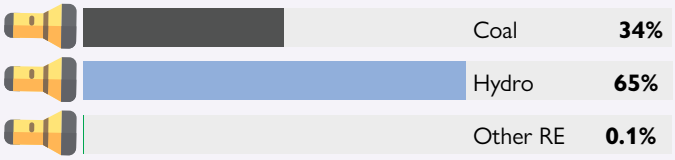
CAMBODIA
2017 Power Generation
6,633 Gwh



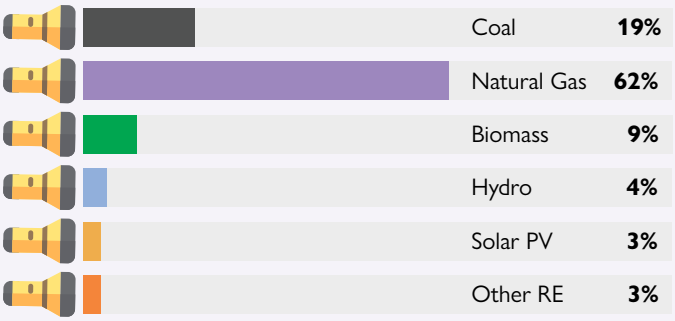
MYANMAR
2017 Power Generation
19,920 Gwh



LAO PDR
2017 Power Generation
31,740 Gwh



THAILAND
2018 Power Generation
187,362 Gwh



Data source: ASEAN-German Energy Programme (AGEP)

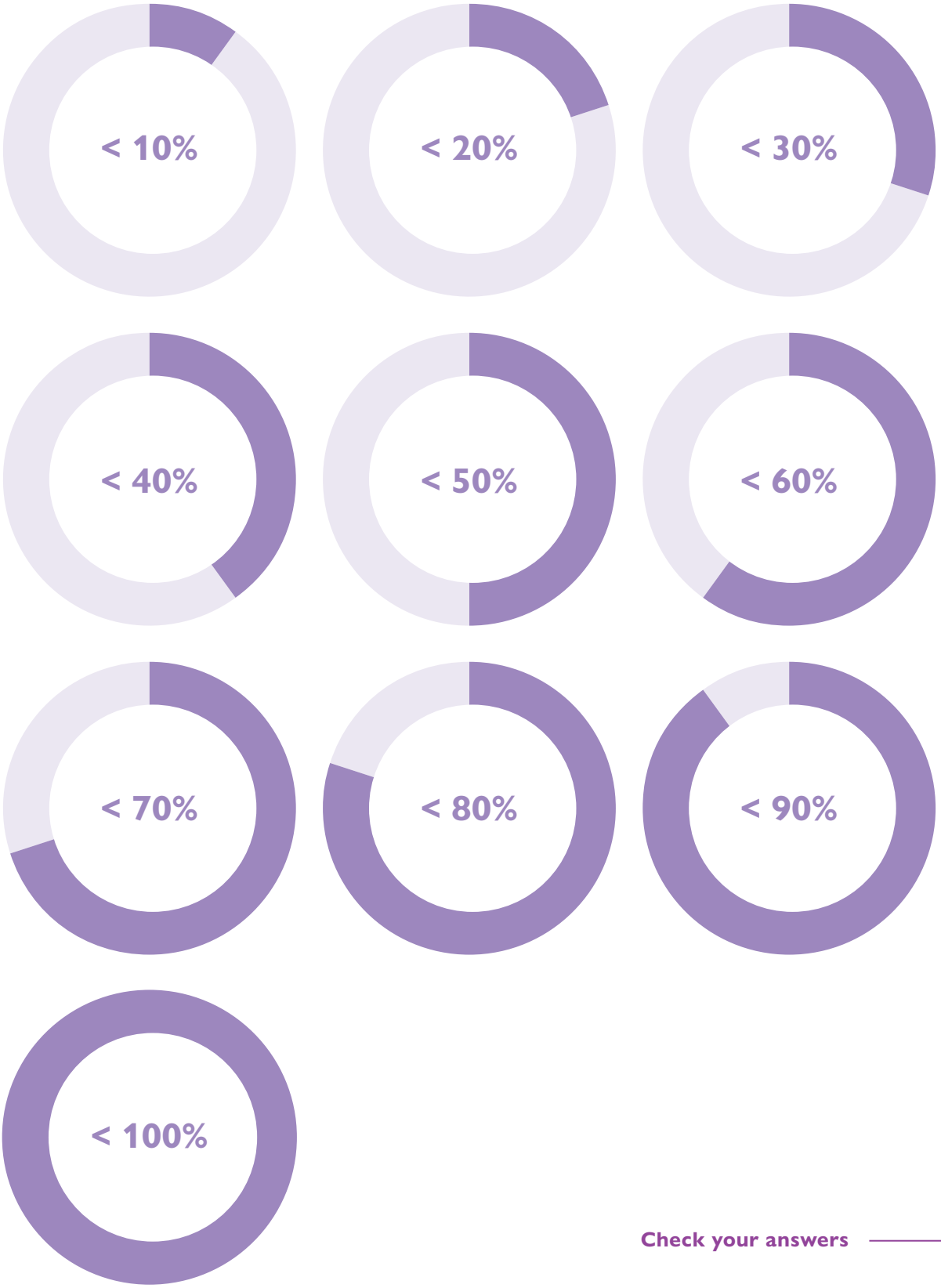
https://agep.aseanenergy.org/ SCAN ME

ENERGY QUIZ 2

ACCESS TO CLEAN COOKING

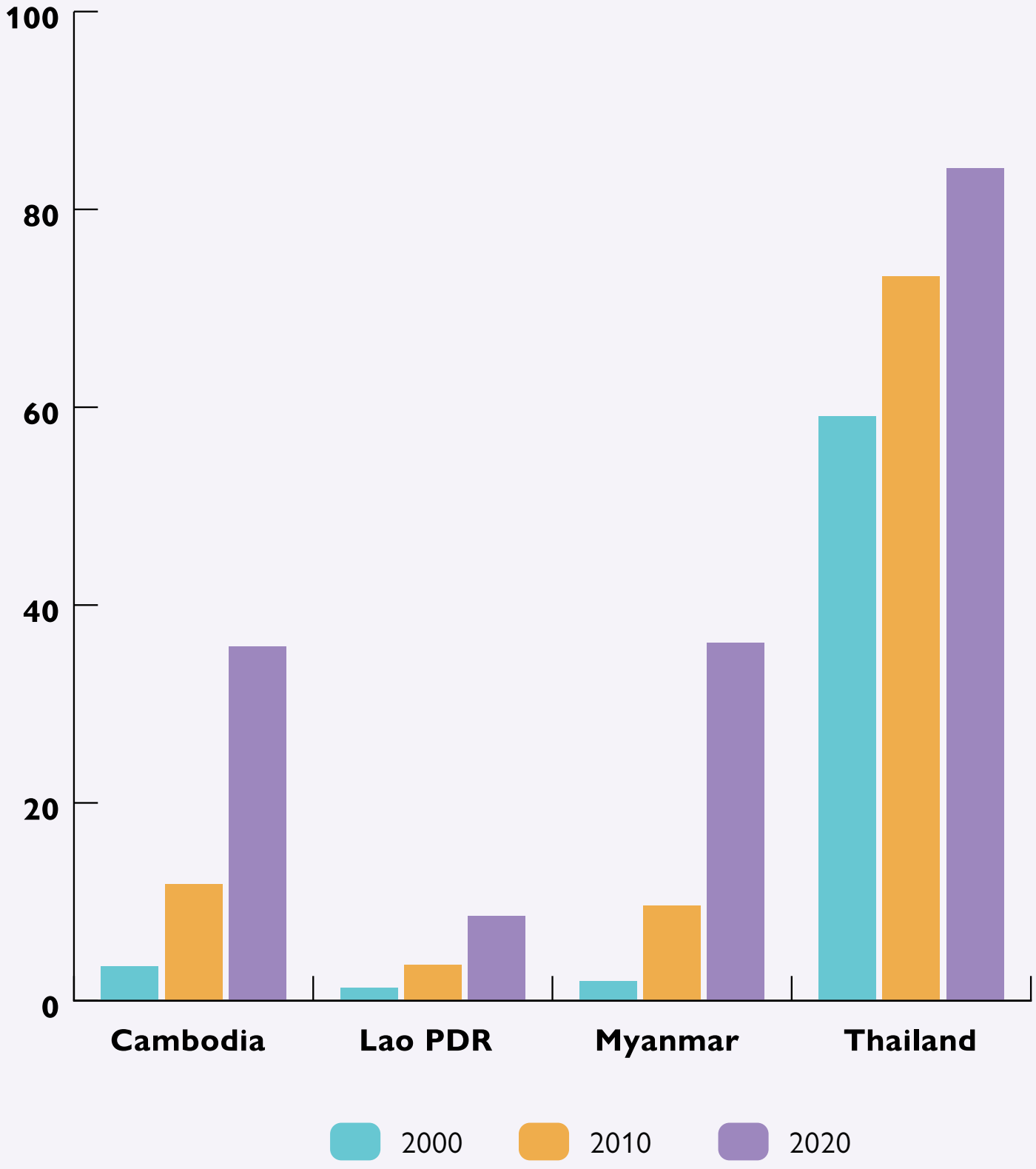
The share of the population in ASEAN that has access to clean cooking varies greatly between countries. According to the ASEAN Centre for Energy (ACE), as of 2017 around 60 million households or 240 million people, were still cooking with traditional biomass or non-modern fuels in ASEAN (ACE, 2020).

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

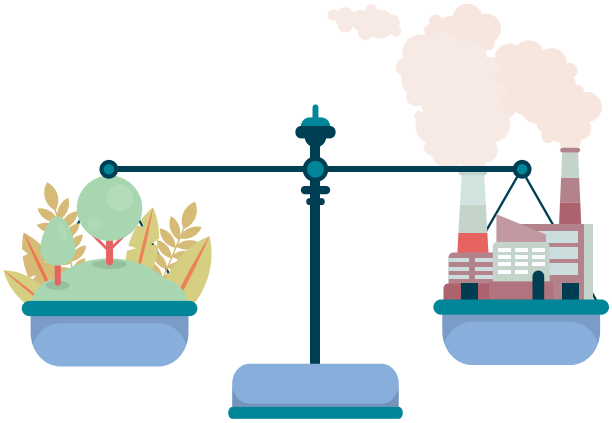
RENEWABLE ENERGY VS. NON-RENEWABLE ENERGY

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

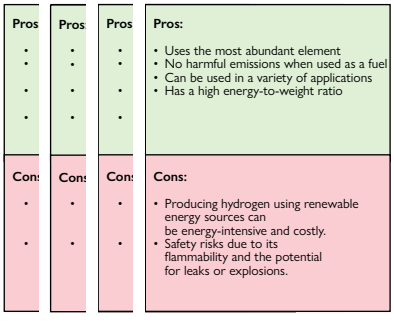
PLACE THE RIGHT SOURCE OF ENERGY IN THIS BLOCK	A type of energy that is generated by utilizing as a fuel source, typically through processes like fuel cells of combustion.
	Pros:
	Cons:

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

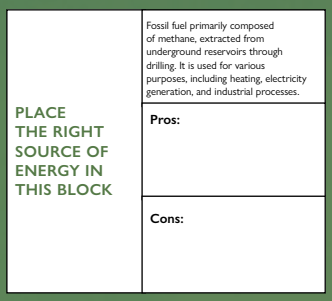
- Look at the Pros & Cons card (deck 3), one card at a time, and match each card with the Energy source. Glue or tape the Pros & Cons card on the Energy card. Repeat the same process until you match all the Pros & Cons cards to the Energy cards.

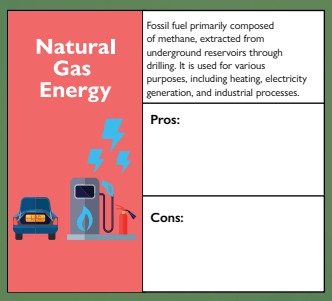
Step 3: Renewable Energy VS Non-Renewable Energy

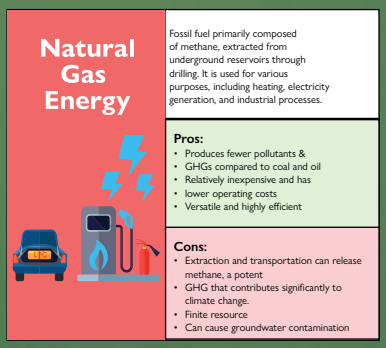
- Use a marker pen to divide a flipchart paper into 2 sections. Write "Renewable Energy" on the left side of the paper and write "Non-Renewable Energy" on the right side of the paper
- Look at all the Energy cards and identify which energy sources are renewable and which ones are non-renewable. Place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

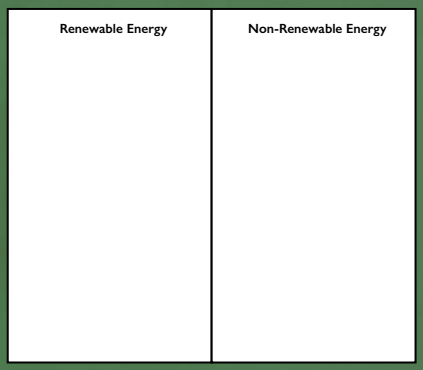
Step 4: Explore and reflect on the current and potential renewable energy sources in your community, along with related policies.

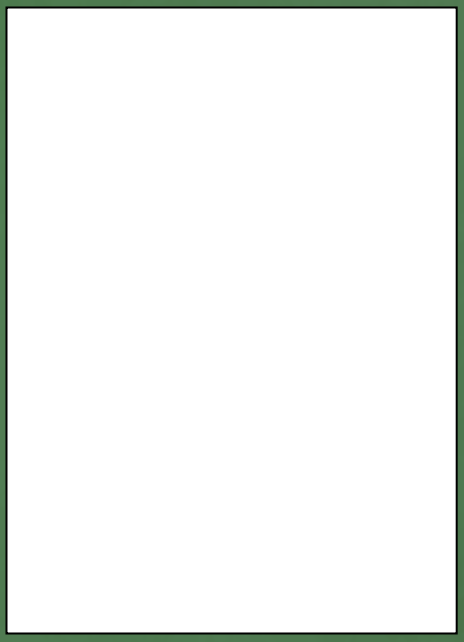
- Use the "My Community's Energy Sources Worksheet" with the guiding questions to explore and reflect on the current and potential renewable energy sources in your community, as well as the related policies.





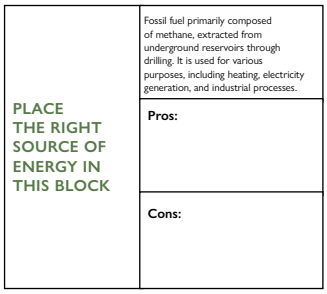






CARD DECK 1 ENERGY CARD

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:

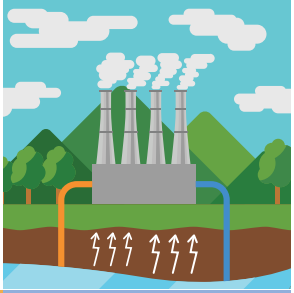
CARD DECK 2

ENERGY SOURCE CARD

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

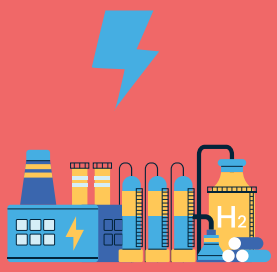
Stack them all into one pile.

Geothermal Energy

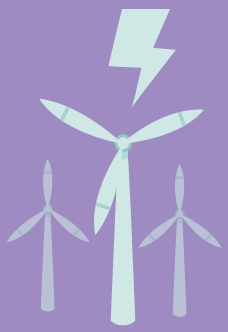


Biomass Energy

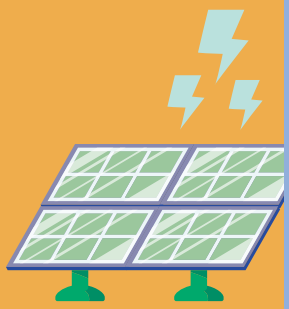
Hydrogen Energy



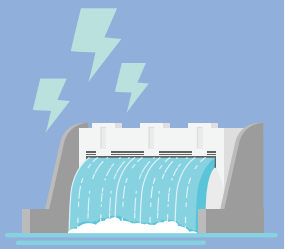
Wind Energy



Solar Energy



Hydro Energy



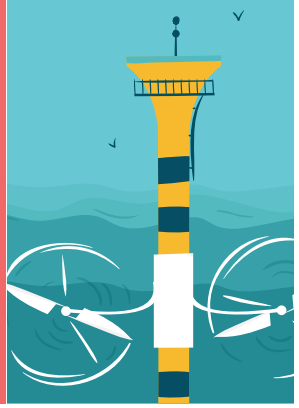
Nuclear Energy

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

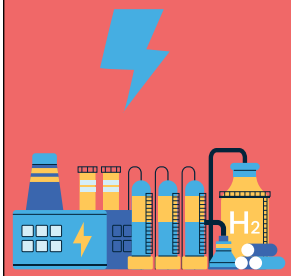
Natural Gas Energy

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.

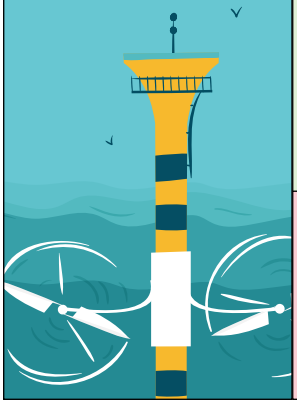
Crude Oil Energy

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

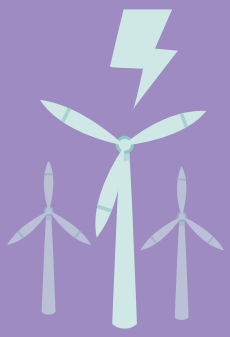
Biomass Energy

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

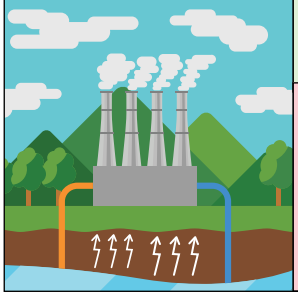


Conversion of kinetic energy of wind into electrical power

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

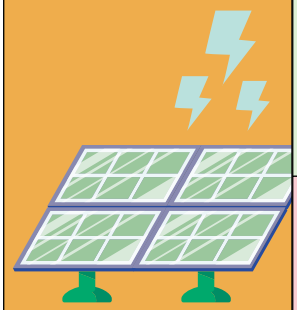


Generating electricity & heat by using the natural heat from inside the Earth

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

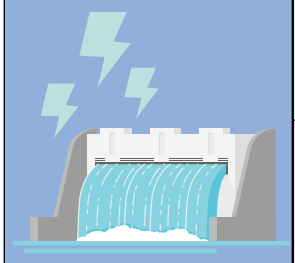


Conversion of energy from sunlight into electricity

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

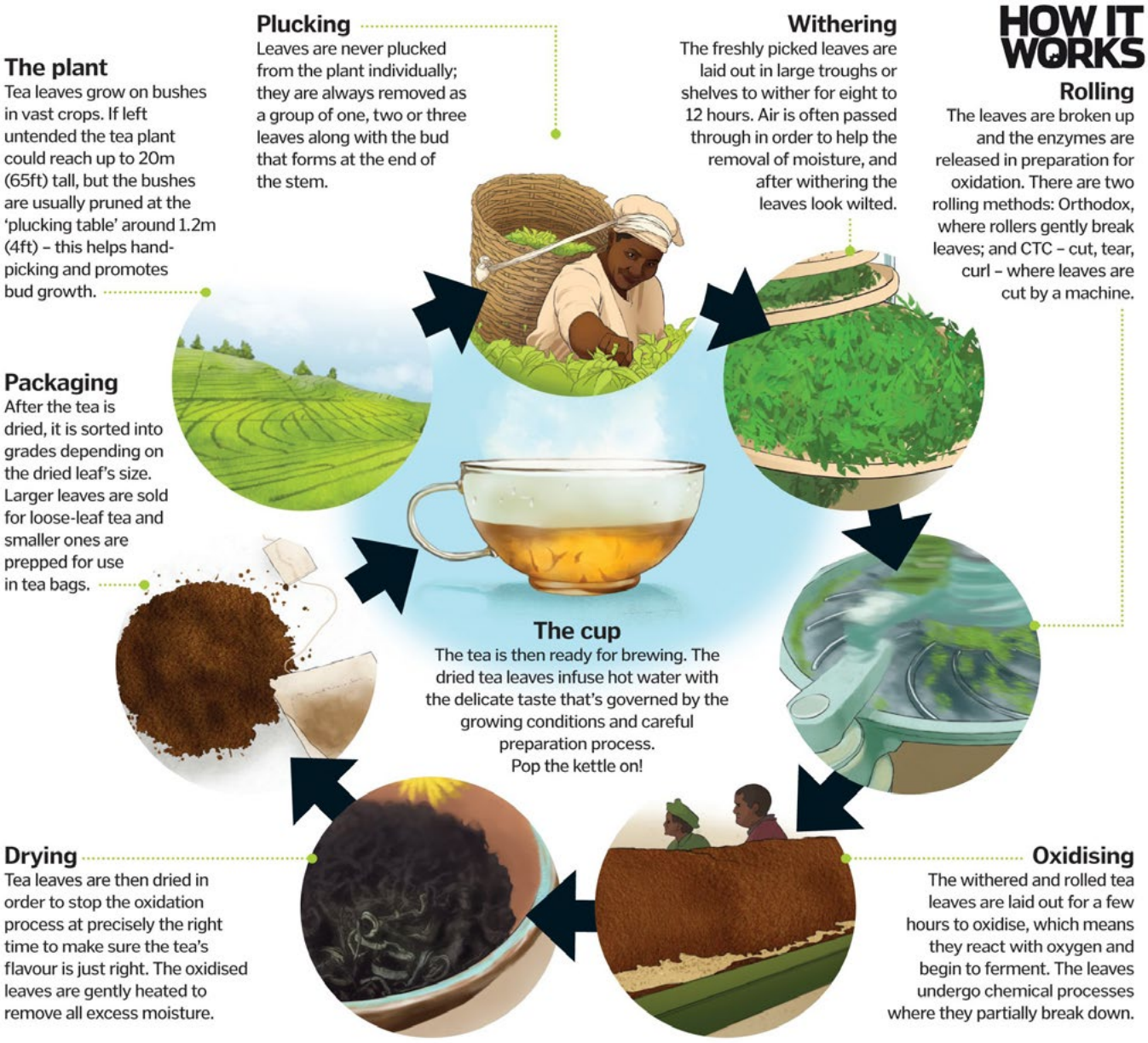
Additional resources to support your thinking process when completing Tasks 1 & 2.

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?

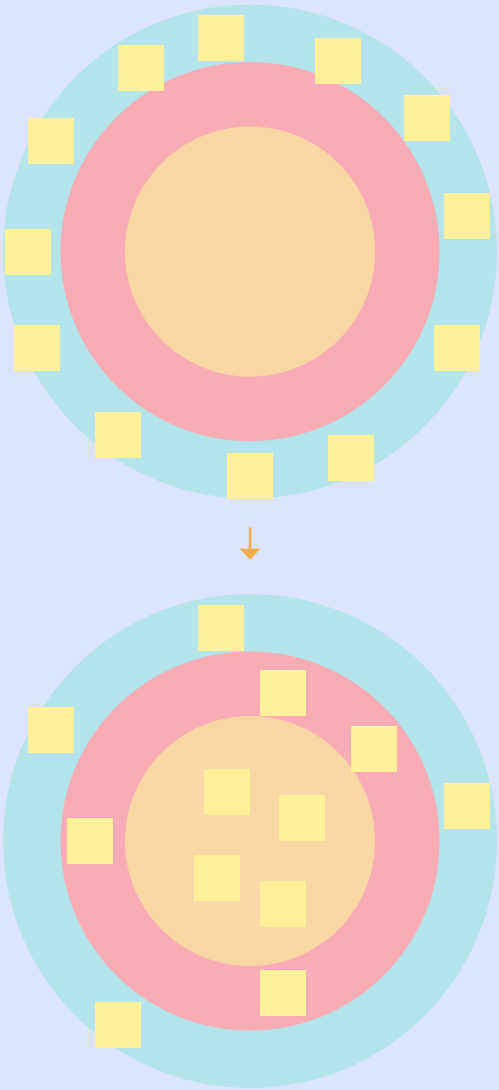
Instructions:

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.

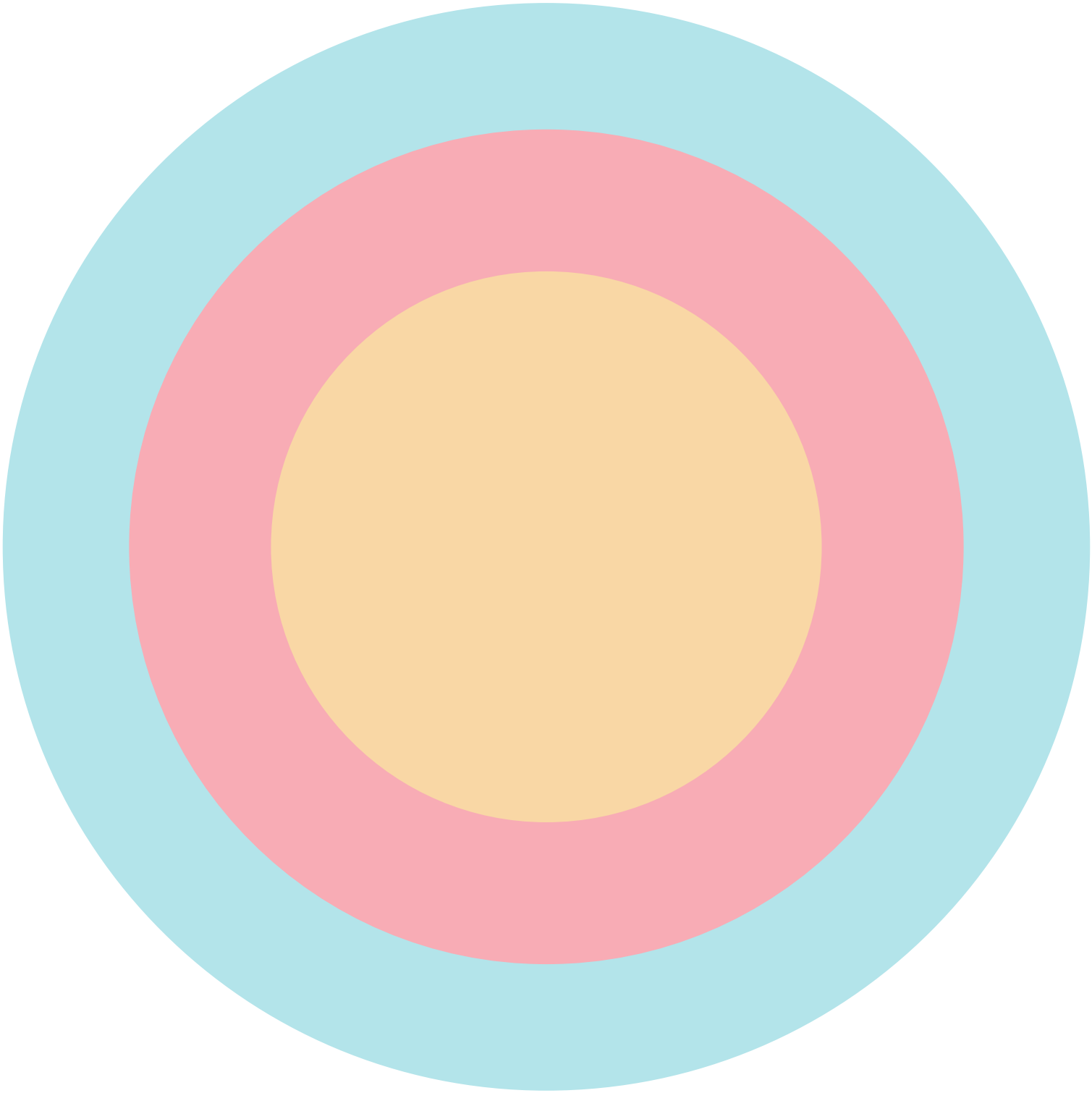
4. Write each suggestion on an individual sticky note, then...
    - Put all the notes on the outer circle of the paper, similar to this example.



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.

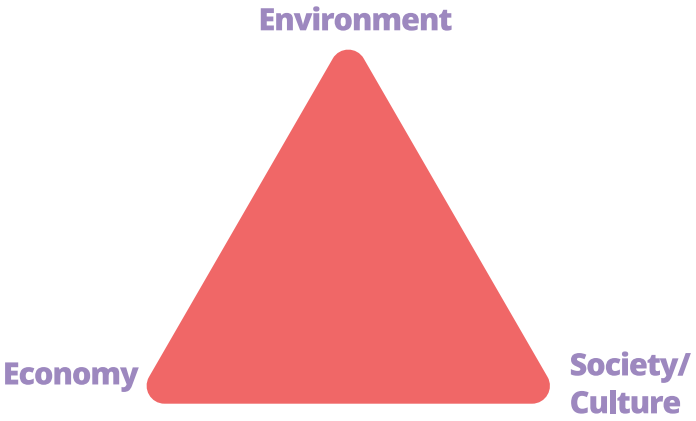
BACKGROUND INFORMATION

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.

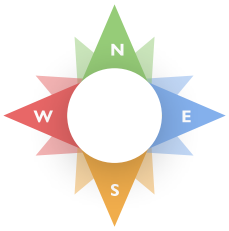
What You Want to Find Out	What Questions We Should Ask	What We Should Observe

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

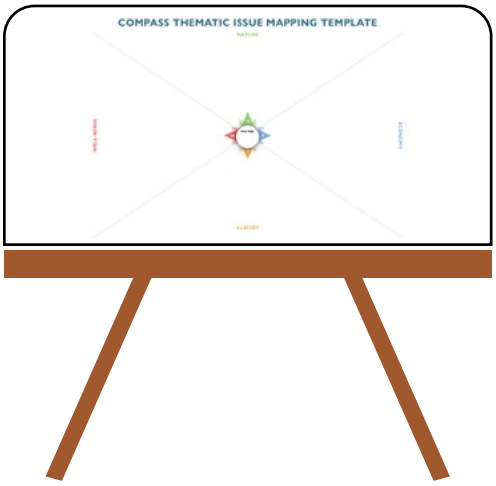
Materials:

- 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**	**SOCIAL SYSTEMS, COMMUNITIES, LAWS AND REGULATIONS, AND CULTURES** **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**	**INDIVIDUAL HEALTH AND HAPPINESS** **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.

The Sustainability Compass
Compass Education

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.

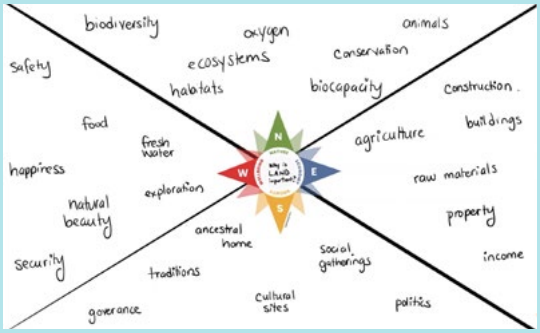
Step 2: Analyze interconnections

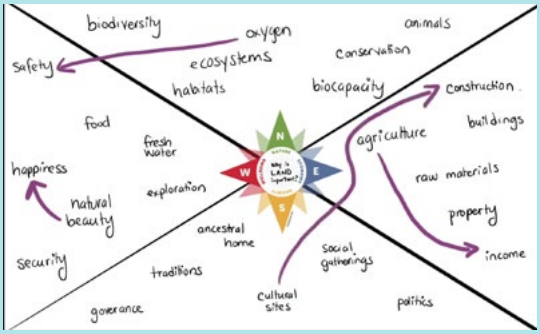
- Discuss with your teammates to identify how factors in different quadrants interrelate in a cause-and-effect relationship (e.g. how agriculture produce affects people's income).
- Draw arrows to indicate connections between them. The arrowhead should point to the factors that are affected by other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

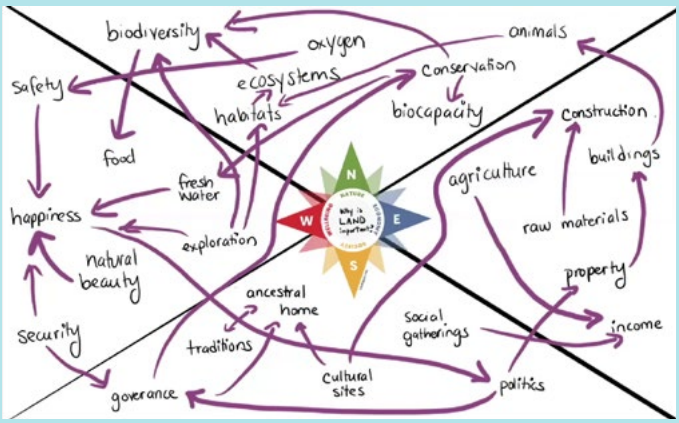
Step 3: Reflection

- 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.



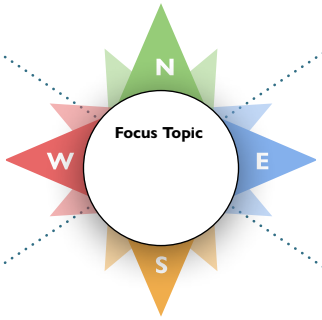




COMPASS THEMATIC ISSUE MAPPING TEMPLATE

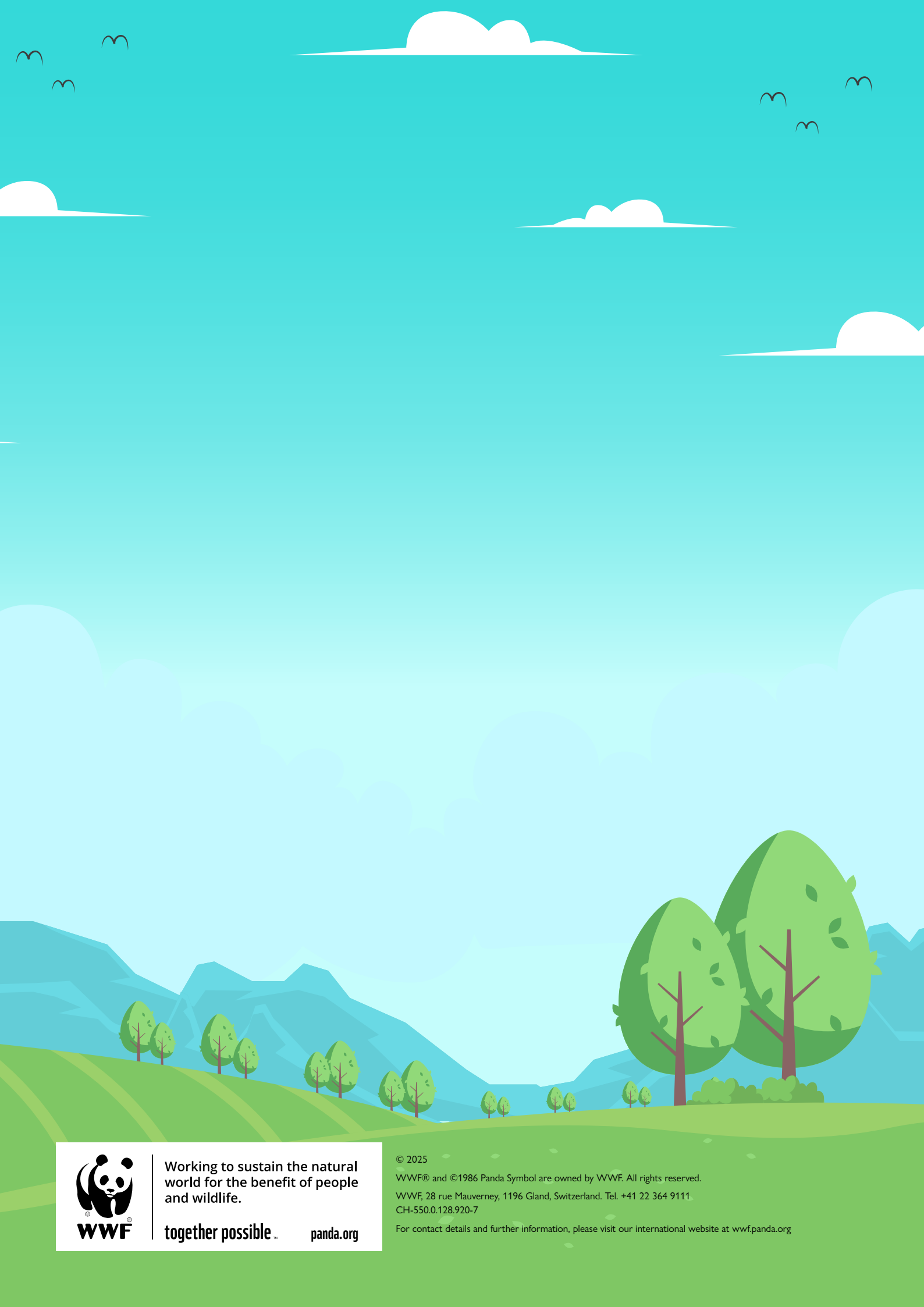
NATURE

WELL-BEING



ECONOMY

SOCIETY



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