CityAdapt – Building Climate Resilience of Urban Systems Through Ecosystem-Based Adaptation (EbA) in the Latin America and Caribbean Region

# CLIMATE CHANGE ADAPTATION AND NATURE– BASED SOLUTIONS TOOLKIT

City Adapt
RECONNECTING CITIES WITH NATURE
LATINAMERICA AND THE CARIBBEAN

JAMAICA

# HIGH SCHOOL STUDENTS GRADE 10–11

December 2023

# CONTENT

# INTRODUCTION

Welcome to an exciting journey of discovery and learning with our "Climate Change Adaptation and Nature-based Solutions Toolkit" designed especially for primary students in Grades 10 to 11.

This toolkit is an integral part of the City Adapt project, initiated by the Global Environment Facility (GEF) and spearheaded by the United Nations Environment Programme (UNEP). It was also created in collaboration with local entities including The Forestry Department, The Nature Conservancy, and the Jamaica 4-H Clubs.

As our world continues to evolve rapidly, the Latin America and Caribbean (LAC) region, including Kingston, Jamaica, is witnessing significant urban expansion. This growth, while promising, brings challenges, particularly in adapting to climate change and preserving our precious natural resources. Understanding these challenges and learning to address them is crucial for our future, and it starts with you and our young learners.

Our toolkit is a result of extensive research and consultation, including a gap analysis that reviewed existing educational resources and practices. We've tailored this toolkit to fill these gaps, ensuring it aligns seamlessly with your current curriculum. It's designed for educators, not just to help teach about climate change and nature-based solutions but to also inspire students to become active participants in creating a sustainable future.

Inside, you will find a range of engaging activities, interactive projects, and resources that make learning about climate change and nature-based solutions not only educational but also fun and memorable. These include hands-on projects, technology-based learning, and interactive games, all created to stimulate your curiosity and encourage critical thinking.

Our approach is holistic and multidisciplinary, aiming to integrate these crucial topics into various subjects already being taught. We believe that by understanding the interconnectedness of our environment, urban development, and climate change, kids will develop a deeper appreciation and a lifelong commitment to sustainable practices.

So, let's embark on this learning adventure together! As you work through this toolkit, remember that each child plays a vital role in shaping our world. Their ideas, actions, and voices are essential in adapting to and mitigating the impacts of climate change. We are excited to see how you, and young environmental stewards, will use this knowledge to make a difference in your communities and beyond.

Happy Learning!

## CLIMATE CHANGE ADAPTATION AND NATURE-BASED SOLUTIONS TOOLKIT OUTLINE HIGH SCHOOL STUDENTS GRADE 10-11

# DEFINITION OF KEY TERMS
# INTRODUCTION

In this essential section, we embark on a journey to demystify some crucial concepts that form the backbone of learning about the environment.

The key terms presented are structured in a progressive hierarchy of understanding, meaning that each definition builds upon the previous one, creating a cohesive and comprehensive learning experience for the children. This approach ensures that as your students' knowledge expands through the lessons, new terms are introduced in a manner that reinforces and deepens their understanding.

We've chosen simple, accessible language for the definitions to ensure that children easily grasp the concepts. It's important to remember that not all terms will be introduced at once. Instead, you, as the educator, will have the flexibility to bring in new terms at the right moments in the learning journey, ensuring that each new concept is introduced at an appropriate stage in the students' developing comprehension.

This methodical and gradual introduction of terms is designed to foster a robust and thorough understanding of climate change adaptation and nature-based solutions among your young learners

# DEFINITIONS

1. Climate (Overall Weather Trend): The average weather conditions in a place over many years.
2. Weather (Daily Weather): The conditions outside on a particular day, such as sunny, cloudy, rainy, or snowy.
3. Pollution (Environmental Harm): Harmful substances released into our air, water, or land that can damage our health and the environment.
4. Climate Change (Shifting Weather Patterns): Long-term changes in temperature and typical weather for a place.

# Climate
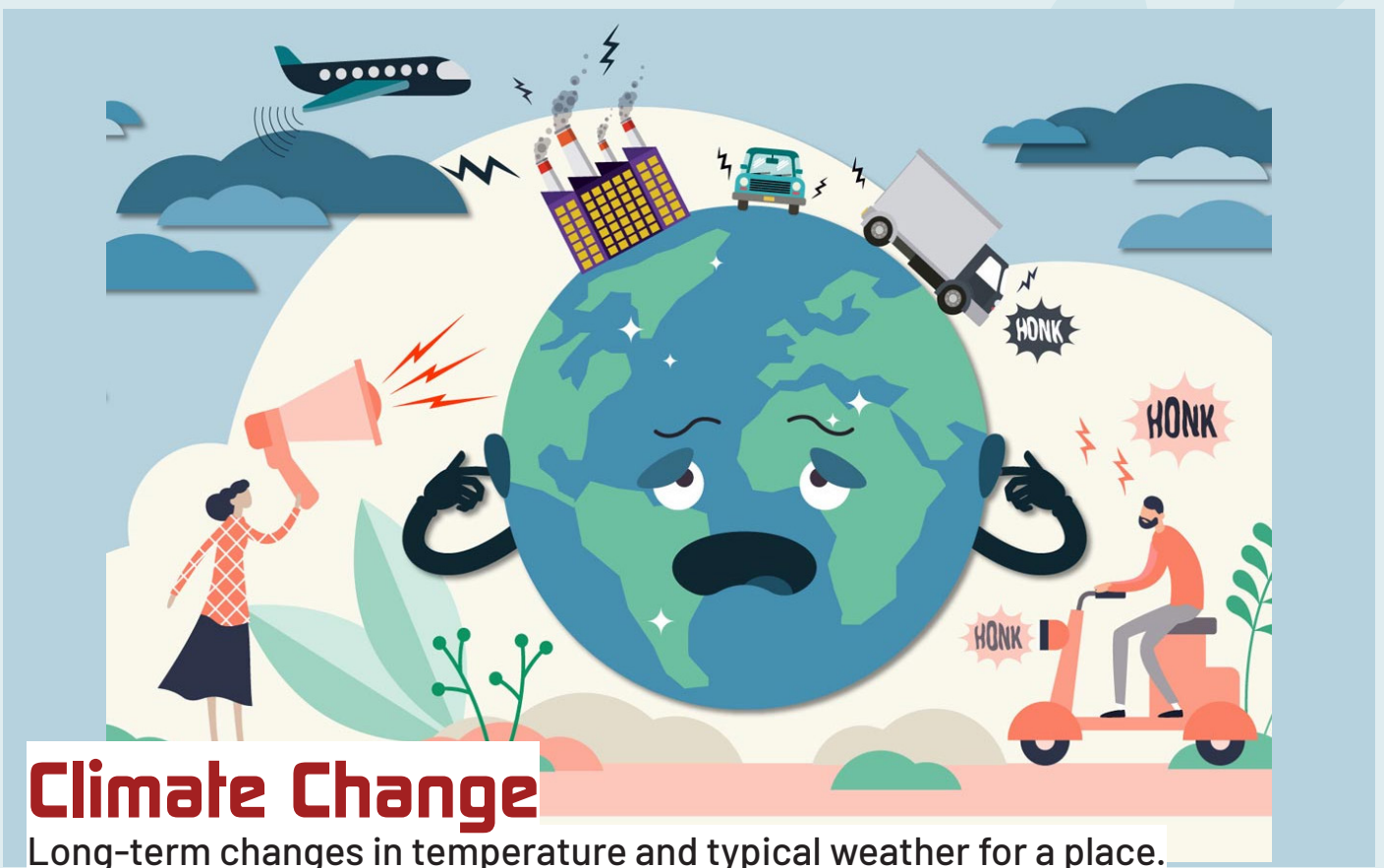The average weather conditions in a place over many years.
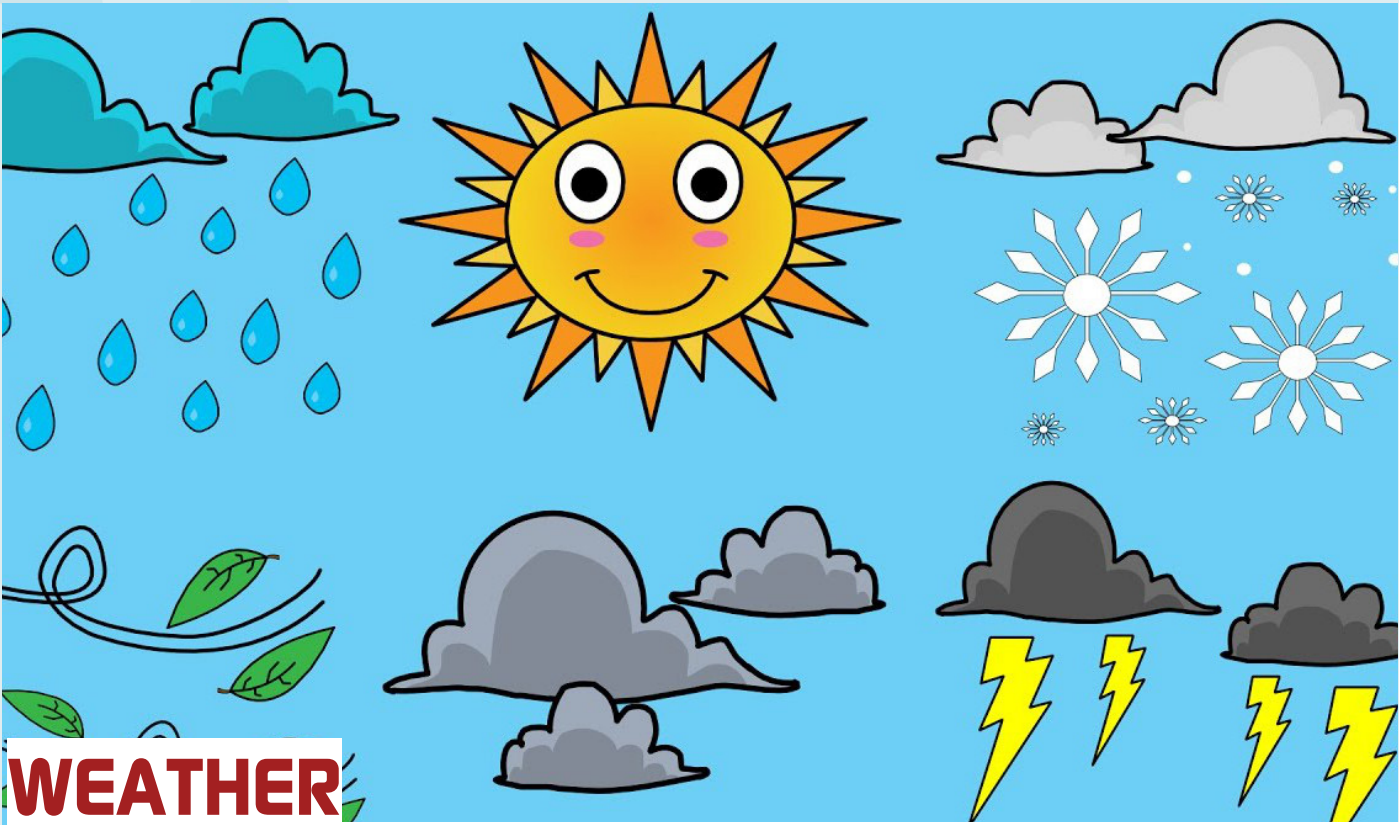


# WEATHER
The conditions outside on a particular day, such as sunny, cloudy, rainy, or snowy.

# Pollution

Harmful substances released into our air, water, or land that can damage our health and the environment.

# Climate Change

Long-term changes in temperature and typical weather for a place.

# How Humans Contribute To Climate Change

## Energy Production and Consumption

Human activities, particularly through the energy matrix involving the extraction, production, and use of fossil fuels (such as coal, oil, and natural gas), significantly contribute to climate change. Burning these fuels for electricity, heating, and transportation releases large amounts of carbon dioxide ($CO_2$) and other greenhouse gases into the atmosphere. These gases trap heat, similar to how a greenhouse works, leading to a warming effect on the planet. The energy sector's reliance on fossil fuels is a major driver of the global increase in atmospheric concentrations of greenhouse gases, making it a critical area for climate change mitigation efforts.

## Industrial Processes and the Production Chain

The production and consumption of goods require energy and raw materials, leading to greenhouse gas emissions at every stage of the production chain—from resource extraction and processing to manufacturing and waste disposal. Industries such as cement, steel, and chemical manufacturing are among the largest sources of direct emissions, releasing not only $CO_2$ but also methane ($CH_4$), nitrous oxide ($N_2O$), and fluorinated gases—all potent greenhouse gases. Efforts to reduce emissions in these sectors involve improving energy efficiency, shifting to lower-carbon energy sources, and adopting innovative production technologies.

## Deforestation and Land Use Changes

Forests act as carbon sinks, absorbing $CO_2$ from the atmosphere through photosynthesis. However, deforestation for agriculture, logging, and urban expansion significantly reduces these carbon sink capabilities, releasing the stored carbon back into the atmosphere. This not only increases $CO_2$ concentrations but also reduces biodiversity and disrupts water cycles. Protecting and restoring forests are vital strategies for maintaining global carbon balance and enhancing ecosystem resilience against climate change

# How Humans Contribute To Climate Change

## High Energy Use in Homes and Buildings

Using a lot of electricity, especially from non-renewable sources like coal and gas, releases greenhouse gases. Turning off lights and using energy-efficient appliances helps reduce this impact."

## Agriculture and Livestock Farming

Farming, especially with a lot of livestock, produces methane, a potent greenhouse gas. Also, using fertilizers in large quantities can release harmful gases."

## Emissions from Air Travel

Airplanes burn a lot of fuel, which releases CO2 and other greenhouse gases. Reducing air travel can lower these emissions.

## Deforestation for Urban Expansion

Clearing forests to build cities and infrastructure reduces the Earth's ability to absorb CO2. Protecting forests is crucial for maintaining our planet's health."

## Plastic Pollution

Producing and disposing of plastic contributes to greenhouse gas emissions. Reducing, reusing, and recycling plastic can help combat climate change."

## Excessive Water Use and Pollution

Overusing water in agriculture and polluting water bodies affect the natural climate balance. Conserving water and preventing pollution are key steps."

# DEFINITIONS

**Climate Change Mitigation (Preventing More Change):**

Actions taken to reduce or stop the effects of climate change, mainly by reducing the things that cause it.

## Examples Of Climate Change Mitigation

**I.     Planting Trees:**
Trees are natural carbon sinks, meaning they absorb carbon dioxide, a significant greenhouse gas. Initiating tree-planting activities in schoolyards, communities, or at home can combat climate change. Trees play a crucial role in regulating climate, and their importance in urban areas, especially for reducing heat islands, is immense. Discussing deforestation's impact on climate change can also provide valuable insights.

**II.     Recycling and Reducing Waste:**
Recycling helps reduce the need for extracting and processing raw materials, which is energy-intensive and emits greenhouse gases. Students can learn about the lifecycle of products and the importance of reducing waste and choosing minimal packaging. This understanding helps lower their carbon footprint and fosters responsible consumption habits.

**III.     Conserving Water:**
Conserving water is essential as significant energy is used in treating and transporting water. Exploring the impacts of water conservation on local ecosystems and the global environment can be enlightening. Investigating water-saving technologies and practices, such as rainwater harvesting or efficient irrigation methods, can broaden students' understanding of sustainable water management.

# Examples Of Climate Change Mitigation

## IV. Using Less Electricity:

Understanding different electricity sources and their environmental impacts is key. Students can explore renewable and non-renewable energy sources, their regional energy mix, and the related environmental consequences. Promoting energy-saving habits and the use of energy-efficient appliances, as well as conducting energy audits at home or school, can be practical and educational.

## V. Walking or Riding Bikes:

"Promoting sustainable transportation like biking, walking, or public transit helps reduce the carbon footprint associated with personal vehicle use. Discussing the broader benefits of sustainable transportation, including healthier lifestyles and reduced traffic congestion, can be impactful. Introducing concepts of urban planning that support sustainable transportation, such as bike lanes and pedestrian-friendly infrastructure, encourages students to think about long-term environmental solutions.

## VI. Supporting Renewable Energy:

Encourage students to learn about renewable energy sources like solar, wind, and hydroelectric power. Discuss how these energy sources reduce reliance on fossil fuels, which are major contributors to greenhouse gas emissions. Students can explore how they can support renewable energy in their community, such as participating in local green energy programs or advocating for renewable energy policies.

## VII. Sustainable Eating Habits:

Discuss the impact of food choices on the environment. Emphasize how consuming locally-sourced, plant-based foods can reduce the carbon footprint associated with food production and transportation. Understanding the environmental impact of meat production, especially beef, can encourage students to make more sustainable dietary choices."

## VIII. Green Building and Design:

ntroduce the concept of green buildings and sustainable architecture. Explain how energy-efficient design, sustainable materials, and green spaces in buildings can

# Examples Of Climate Change Mitigation

reduce energy consumption and environmental impact. Students can research green building practices and consider how they can be implemented in their school or community projects.

### IX. Promoting Public Transit and Carpooling:

Highlight the benefits of using public transportation and carpooling over individual car use. Discuss how these methods can significantly reduce greenhouse gas emissions, decrease traffic congestion, and improve air quality. Encourage students to research and advocate for improved public transit options in their area and consider organizing a carpooling system for school or extracurricular activities.

# DEFINITIONS

**Climate Change Adaptation (Preparing for Change):**
Making changes to our lifestyles or surroundings to handle the effects of climate change better.

**Difference between Climate Change Mitigation and Climate Change Adaptation:**
While Mitigation focuses on preventing or slowing down climate change, Adaptation prepares us to live with the effects of the changes.

# CLIMATE ADAPTATION EXAMPLES

**Climate Change Adaptation Examples (Weather Adjustments):**

**A. Coastal Erosion Management:** Discuss the impact of climate change on coastal erosion. Students can learn about the importance of mangroves and coral reefs in protecting shorelines and study methods to prevent coastal erosion, such as planting mangroves or constructing sea walls. This can be linked to geography and environmental science topics.

**B. Heat-Resistant Building Design:** Explore how buildings can be designed or modified to stay cooler in increasingly hot temperatures. This includes understanding the principles of passive cooling, using reflective materials, and effective ventilation. This topic can be integrated into physics and design technology classes.

**C. Sustainable Fishing Practices:** With climate change affecting marine life, sustainable fishing becomes crucial. Students can study the impact of overfishing and climate change on marine ecosystems and learn about sustainable fishing methods. This can be part of biology and environmental studies.

**D. Disaster-Resilient Agriculture:** TIn areas prone to extreme weather, learning about disaster-resilient agricultural practices is vital. This could involve understanding crop rotation, intercropping, and the use of weather-resistant crop varieties. These concepts can be incorporated into agricultural science courses.

# CLIMATE ADAPTATION EXAMPLES

**E. Renewable Energy Projects:** Encourage students to explore and participate in renewable energy projects, such as solar panel installations or small-scale wind energy projects. This hands-on experience can be part of physics and technology education, helping students understand alternative energy sources and their role in combating climate change.

**F. Water Conservation Techniques:** Teach about advanced water conservation techniques, like greywater recycling and efficient irrigation methods. This can be part of a broader discussion in science classes about water resources management and its importance in a changing climate.

**G. Community Awareness Campaigns:** Students can initiate or participate in community awareness campaigns to educate others about climate change impacts and adaptation strategies. This activity can develop communication skills and can be integrated into social studies and language arts curricula.
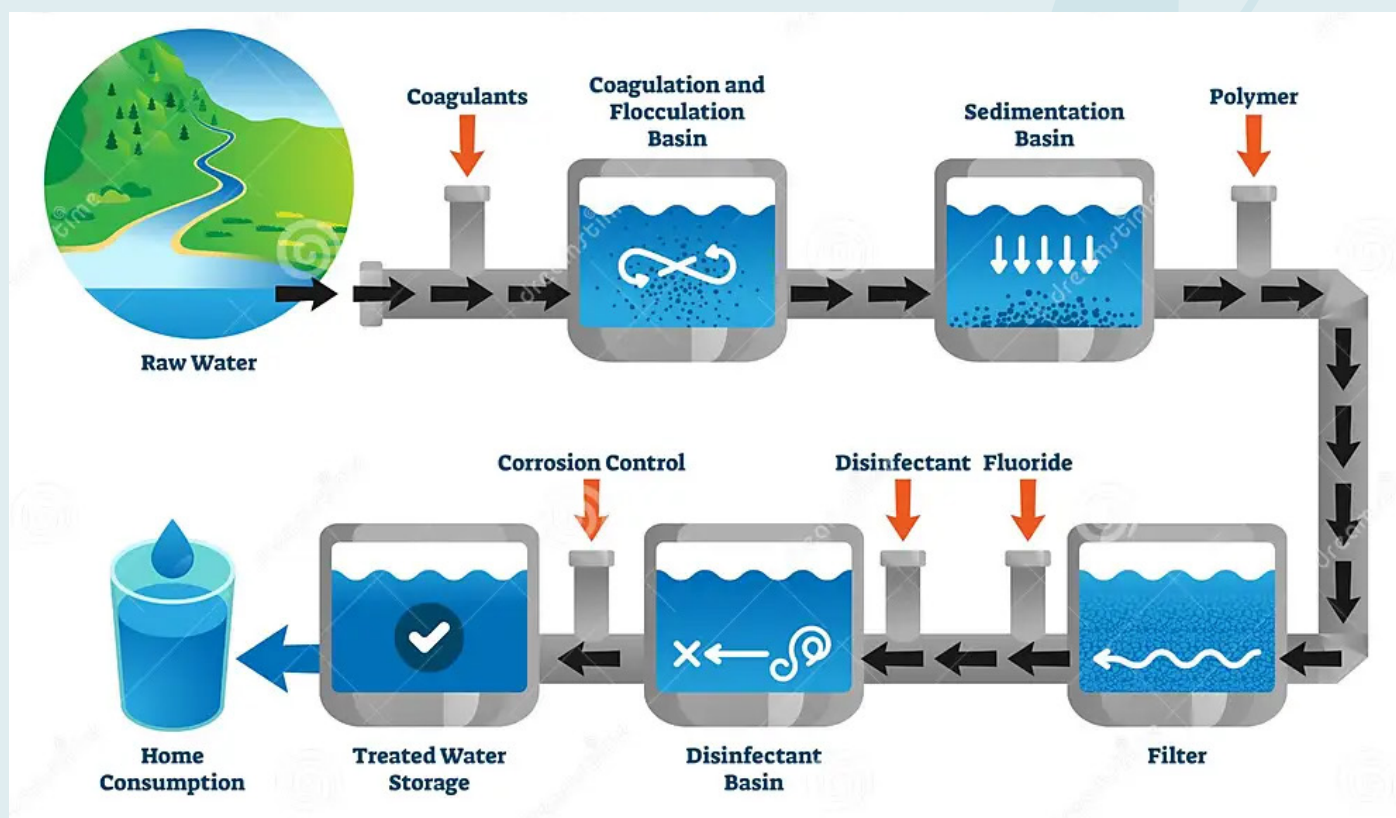
# DEFINITIONS

**Biodiversity Loss (Vanishing Wildlife):**

The decrease or loss of various species of plants and animals in an environment.

**Ecosystem Services (Nature's Bene its):**

The valuable functiona nature provides, such as clean air, clean water, and food.

**Nature-Based Solutions (Nature's Solutions):**

Strategies that use the natural environment to address societal challenges.

# Examples of Nature-based Solutions

## A. Mangrove Restoration:
a. Full Explanation: Mangroves are exceptional carbon sinks, meaning they absorb and store a significant amount of $CO_2$ from the atmosphere. They also provide strong natural barriers against storm surges and coastal erosion, which are exacerbated by climate change.
b. Connection to Subjects: Geography (coastal management), Biology (ecosystems and carbon cycle), Environmental Science (climate change mitigation).

## B. Community Rain Gardens:
a. Full Explanation: Rain gardens help manage stormwater, reducing urban runoff and soil erosion. They enhance local biodiversity and contribute to cooling urban environments, which is crucial as cities often experience higher temperatures due to climate change.
b. Connection to Subjects: Botany (plant biology and soil interaction), Urban Planning (sustainable urban design), Earth Science (water cycle and urban heat island effect).

## C. Agroforestry Practices:
a. Full Explanation: By integrating trees into agricultural practices, agroforestry enhances biodiversity, improves soil health, and increases carbon storage. This helps in adapting to climate change by reducing atmospheric $CO_2$ levels and enhancing the resilience of agricultural systems to climate extremes.
b. Connection to Subjects: Agricultural Science (sustainable farming), Biology (biodiversity and carbon sequestration), Environmental Studies (land use and climate change adaptation).

# Examples of Nature-Based Solutions

**D. Urban Green Spaces:**
   a. Full Explanation: Urban green spaces absorb CO2 and help mitigate the urban heat island effect, leading to cooler urban environments. They also improve air quality and provide recreational spaces, enhancing overall urban resilience to climate change.
   b. Connection to Subjects: Urban Studies (city planning and ecology), Social Studies (public health and environment), Environmental Science (ecosystem services and climate adaptation).

**E. Coral Reef Conservation:**
   a. Full Explanation: Coral reefs play a crucial role in carbon cycling and marine biodiversity. Protecting and conserving coral reefs helps maintain healthy ocean ecosystems, which are vital in regulating the Earth's climate.
   b. Connection to Subjects: Marine Biology (reef ecosystems), Environmental Science (ocean's role in climate regulation), Geography (coastal systems).

**F. Bioengineering for Erosion Control:**
   a. Full Explanation: Bioengineering methods use plants and natural materials to stabilize soils and prevent erosion, crucial in maintaining landscapes and preventing land degradation, which can be intensified by climate change-induced weather events.
   b. Connection to Subjects: Biology (plant-root systems and soil stabilization), Geography (landforms and erosion), Engineering (sustainable and eco-friendly construction).

**G. Water Harvesting and Conservation:**
   a. Full Explanation: Rainwater harvesting reduces dependence on traditional water sources and enhances water security, which is increasingly under threat due to climate change. Conserving water also reduces the energy used in water treatment and distribution.
   b. Connection to Subjects: Environmental Science (water resource management), Physics (principles of water harvesting systems), Geography (climate patterns and water scarcity).

# DEFINITIONS

**Green Infrastructure (Nature-Designed Areas):** Natural areas in cities, like parks and gardens, which provide benefits like clean air and places for people to relax.

**Resilience (Bouncing Back):** The ability to recover and adapt after problems or disasters.

**Adaptive Capacity (Ability to Adapt):** The capability of a system to adjust and modify itself to changing conditions.

**Blue Carbon (Sea Plant Power):** Carbon that's stored by ocean plants, which helps in keeping our atmosphere balanced.

**Carbon Sequestration (Trapping Carbon):** The process by which plants and other systems remove carbon dioxide from the air and store it.

**Ecological Restoration (Nature Recovery):** Repairing and restoring damaged parts of nature to their natural state.

**Regenerative Agriculture (Sustainable Farming):** Farming that improves the land's health and its ability to store carbon.

**Managed Retreat (Planned Relocation):** Strategically moving away from areas at high risk due to climate changes, like rising sea levels.

**Climate Refugees (Climate-Displaced People):** Individuals who must leave their homes due to the effects of climate change.

# ENGAGING ACTIVITIES AND PROJECTS

## INTRODUCTION

Welcome to the vibrant and hands-on world of "Engaging Activities and Projects"! In this lively section of our toolkit, we aim to bring the concepts of climate change adaptation and nature-based solutions to life for our young learners. Our objective here is clear and purposeful: to provide a series of hands-on, interactive experiences that not only reinforce students' understanding of these crucial topics but also ignite their curiosity and enthusiasm for learning.

As educators, you know that the most impactful lessons are those where students can actively participate and apply their learning in practical ways. This section is designed to do just that, through a variety of dynamic and enjoyable activities. We've divided the section into three main categories, each offering a unique approach to engaging young minds:

**Research Activities:** Here, students will embark on mini-explorations and investigations, turning them into young researchers. These activities are crafted to be both informative and enjoyable, encouraging students to delve deeper into the topics of climate change and nature-based solutions in a way that resonates with their natural curiosity and creativity.

**Games and Interactive Learning:** Learning through play is a powerful tool, and this subsection leverages that by introducing a range of games and interactive learning experiences. These activities are designed to reinforce key concepts while keeping students engaged and motivated. Whether it's a board game, a digital interactive, or a role-playing scenario, each game provides a fun and memorable way to understand and internalize important environmental lessons.

**STEM Activities:** Focusing on Science, Technology, Engineering, and Mathematics (STEM), this section offers activities that blend environmental education with critical thinking and problem-solving skills. From building models to conducting simple experiments, these activities help students see the practical applications of what they learn, fostering a deeper appreciation for how science and innovation can be harnessed to address environmental challenges.

# ENGAGING ACTIVITIES AND PROJECTS

Through these engaging activities and projects, we aim to foster not just knowledge, but a sense of excitement and passion for environmental stewardship among our young learners. Let's inspire the next generation of climate change adaptors and nature-based solution innovators!

# RESEARCH & INNOVATION ACTIVITIES

# RESEARCH & INNOVATION ACTIVITIES

# Climate Change Agreements and Justice: A Role-Play Simulation

**Objective:**
To provide students with an interactive understanding of major climate change agreements, the role of Conferences of the Parties (COPs), and the concept of climate justice. This activity aims to foster critical thinking, negotiation skills, and awareness of global climate policies.

**Activity Design for Teachers:**

**Preparation:**
1. Research and prepare briefs on the Kyoto Protocol, the Paris Agreement, and key COP meetings.
2. Develop country/character cards representing different countries, NGOs, and interest groups. These cards should not give all the details but should provide enough information to point students assigned the character/country/role in the right direction. This approach encourages students to conduct their own research, enabling them to properly build their character and script for the role play. The aim is to foster deeper understanding and engagement through exploration and discovery.
3. Create scenario sheets describing various climate justice issues.
4. Set up the classroom to mimic a conference setting.

# Climate Change Agreements and Justice: A Role-Play Simulation

**Instructions for Students:**

- **Introduction:** Explain the basics of the Kyoto Protocol, the Paris Agreement, and the significance of COPs.
- **Role Assignment:** Distribute character cards and scenario sheets to groups. Each group represents a different stakeholder.
- **Research and Discussion:** Allow time for students to research their roles and the specific issues on their scenario sheets.
- **Role-Play Simulation:** Conduct a mock COP meeting where groups negotiate, debate, and propose solutions to the given scenarios.
- **Reflection and Discussion:** After the simulation, conduct a debriefing session. Discuss what was learned about climate agreements and climate justice.

**Materials Needed:**

- Briefs on climate agreements and COPs.

- https://www.un.org/en/climatechange/paris-agreement#:~:text=Today%2C%2195%20Parties%20(194%20States,strengthen%20their%20commitments%20over%20time.

  https://unfccc.int/kyoto_protocol#:~:text=In%20short%2C%20the%20Kyoto%20Protocol,accordance%20with%20agreed%20individual%20targets.

  https://www.britannica.com/event/Kyoto-Protocol

  https://unfccc.int/conference/copenhagen-climate-change-conference-december-2009#ifp

# Climate Change Agreements and Justice: A Role-Play Simulation

- Country/Character cards and scenario sheets.
- Research materials (books, articles, internet access).
- Props for the conference setting (tables, chairs, name tags).

**Assessment Criteria:**
- Participation and engagement in the role-play.
- Understanding of the assigned role and issues.
- Quality of negotiation and problem-solving during the simulation
- Reflection on the learning experience and the concepts of climate agreements and justice.

**Teaching Tips:**

- Tailor the complexity of the roles and scenarios to suit the students' level.
- Encourage students to research real-world positions and policies of the stakeholders they represent.
- Use multimedia resources (videos, documentaries) to supplement learning.
- Facilitate discussions post-activity to ensure a deeper understanding of the concepts.

**This activity is designed to be engaging, thought-provoking, and relevant to the age group, aligning with their educational level and the context of Jamaican climate issues.**

# SAMPLE CHARACTER/ COUNTRY BRIEFS

### The United States:
The United States was the largest emitter of greenhouse gases at the time the Kyoto Protocol was signed, and its participation was seen as critical to the success of the agreement. However, the U.S. Senate never ratified the treaty, and the country ultimately did not participate in the Kyoto Protocol.

### Japan:
Japan was the second-largest emitter of greenhouse gases at the time the Kyoto Protocol was signed and played a significant role in the negotiations. The country committed to reducing its emissions by 6% below 1990 levels by 2012.

### The European Union:
The European Union was a major player in the negotiations and committed to reducing its emissions by 8% below 1990 levels by 2012. The EU also played a key role in developing the carbon credit trading system established by the treaty.

### China:
While China was not a major emitter of greenhouse gases at the time the Kyoto Protocol was signed, it has since become the world's largest emitter. The country was not required to reduce its emissions under the treaty, but it did participate in the carbon credit trading system.

# SAMPLE CHARACTER/ COUNTRY BRIEFS

**Russia:**
Russia's participation in the Kyoto Protocol was critical to its success. The country's ratification of the treaty allowed it to come into force, and Russia ultimately played a significant role in the carbon credit trading system

**Greenpeace International:**
Greenpeace International, a leading environmental NGO, actively campaigned for strong and effective climate action during the Kyoto Protocol negotiations. Advocated for ambitious emission reduction targets and opposed loopholes like excessive use of carbon credits.

**The World Business Council for Sustainable Development (WBCSD):**
The WBCSD, comprising influential corporations, focused on the business perspective in climate change discussions. Promoted market-based solutions and the role of technology in reducing emissions.

# RESEARCH & INNOVATION ACTIVITIES

# ENVIRONMENTAL DYNASTIES - DEBATE ACTIVITY

**Objective:**
To engage high school students in Grades 10-11 in critical thinking and discussions through organized debates on various environmental topics, such as climate change, ecosystem restoration, conservation, and sustainable practices.

**Activity Design for Teachers:**

**Preparation:**
* Select a range of debate topics relevant to environmental issues, ensuring they are suitable for the understanding level of students in Grades 10-11.
* Prepare guidelines for the debate format, including time limits, structure of arguments, and rules of conduct.
* Organize students into teams, ensuring a balanced skill set in each group.
* Provide resources for students to research their debate topics.

# ENVIRONMENTAL DYNASTIES - DEBATE ACTIVITY

**Instructions for Students:**

1. **Topic Assignment and Team Organization:** You will be divided into teams and assigned a topic for debate related to environmental issues. Each team will represent either the 'pro' or 'con' side of the argument.

2. **Research and Preparation:** Your team will need to research your topic thoroughly. This includes understanding both sides of the argument, even though you will be debating for one side.

3. **Debate Structure:** Each team will have an allocated time to present their arguments, followed by a rebuttal session. Ensure your arguments are clear, well-structured, and supported by facts.

4. **Presentation and Conduct:** During the debate, present your arguments confidently and respectfully. Listen carefully to the opposing team and respond thoughtfully during rebuttals.

5. **Judging and Feedback:** Debates will be judged based on the clarity of your arguments, how well you've researched your topic, and your ability to engage in respectful dialogue. Constructive feedback will be provided after each debate.

6. **Re lection Session:** After the debates, we will have a reflection session where you can share what you've learned and how you think these issues could be addressed in the real world.

**Materials Needed:**
- Resources for researching debate topics
- Timer for managing debate segments
- Score sheets for judges (if applicable)

**Assessment Criteria:**
- **Content Knowledge:** Understanding and accuracy of the information presented.
- **Argument Quality:** Clarity and persuasiveness of arguments.
- **Rebuttal Effectiveness:** Ability to respond to opposing arguments.

# ENVIRONMENTAL DYNASTIES - DEBATE ACTIVITY

- **Presentation Skills:** Confidence and respectfulness during the debate.

**Teaching Tips:**
- Encourage students to look at their topics from various perspectives to build a well-rounded argument.
- Monitor the debates to ensure a respectful and constructive environment.
- Use the reflection session to highlight the importance of informed discussions in addressing environmental issues.

# ENVIRONMENTAL DEBATE TOPICS FOR HIGH SCHOOL STUDENTS (GRADES 10-11)

1. **Ban on Single-Use Plastics:**
   Resolved: The Jamaican government should enforce a total ban on single-use plastics to protect the environment."

2. **Coral Reef Conservation vs. Tourism Development:**
   Resolved: Protecting coral reefs should take precedence over tourism development in the Caribbean."

3. **Renewable Energy Transition:**
   Resolved: Caribbean nations should invest heavily in renewable energy sources, even if it means significant changes in current economic structures."

4. **Mangrove Restoration vs. Coastal Development:**
   Resolved: Mangrove restoration is more important than coastal development for the protection of Caribbean ecosystems."

5. **Climate Change Education in Schools:**
   Resolved: Climate change education should be mandatory in all Jamaican and Caribbean schools."

6. **Deforestation for Agriculture:**
   Resolved: The economic benefits of expanding agricultural land in Jamaica justify deforestation."

7. **Fishing Regulations to Protect Marine Life:**
   Resolved: Strict fishing regulations are necessary to preserve marine biodiversity in the Caribbean Sea."

8. **Use of Pesticides in Farming:**
   Resolved: The use of pesticides in farming should be significantly reduced to protect the environment in Jamaica."

9. **Eco-Tourism vs. Traditional Tourism:**
   Resolved: Eco-tourism should be the primary focus of tourism development in the Caribbean."

# ENVIRONMENTAL DEBATE TOPICS FOR HIGH SCHOOL STUDENTS (GRADES 10 -11)

**10.    Public Transportation and Pollution:**
Resolved: Improving public transportation is the most effective way to reduce pollution in major Jamaican cities."

These topics are designed to be thought-provoking and relevant to the Jamaican and Caribbean context, encouraging students to explore and debate both sides of environmental issues. They cover a range of topics, from policy and conservation to economic development and education, providing ample opportunity for balanced arguments and critical discussions.

# GAMES AND INTERACTIVE LEARNING

# GAMES AND INTERACTIVE LEARNING

# JOURNEY TO A BALANCED SOCIETY

**A Ludi and Monopoly Inspired Game on Climate Change and Development**

## Objective:
Students will learn about the various social, economic, and climate challenges that countries face in their quest to achieve a "Balanced Society". They will choose solutions for each challenge their country encounters and experience the consequences of their choices.

The goal is to demonstrate an understanding of global interconnectedness and the importance of strategic decision-making in sustainability.

## Game Description:
Journey to a "Balanced Society" inspired Ludi and Monopoly. The players represent different countries and the game features real-world scenarios, requiring players to make choices on how to balance economic stability, environmental protection, and social welfare. The player who makes the best decisions and effectively navigates these challenges will reach the Balanced Society square first and win the game.

## Components:
- **Game Board:** Designed similarly to a Ludi board, it has four home squares that represents 4 countries. When players roll the dice and travel around the board, they land on squares that present either good or bad events.
- **Good Event Squares:** Landing on these squares brings positive developments or opportunities. Each good event square details a specific reward or advantage, such as moving forward, receiving extra funds, or other beneficial actions that aid players in their journey towards a balanced society.
- **Bad Event Squares:** These squares represent the challenges and hurdles that

# JOURNEY TO A BALANCED SOCIETY

countries often face. Each bad event square outlines a specific problem, such as an environmental crisis or economic downturn, and prompts players to purchase one of the available solutions using their money cards. The choice of solution impacts the player's progress, either keeping them in place or allowing them to advance or move backward, depending on the strategic decisions they make.

- **Money Cards:** A set of 68 cards in various denominations ($10,000, $100,000, $500,000, $1,000,000), including 8 Lucky Break cards. These are used for financial transactions within the game and to purchase solutions.
- **Solution Cards:** A stack of 30 cards representing 14 different solutions to the challenges posed in the game. Each card details the solution's name, number, and cost, and students must decide which if any they want to purchase when faced with bad events.

## How to Play:

1. **Setup:**
   Position the game board in the center of the table. Each player selects a country and places their token at the starting position. Shuffle and distribute 12 money cards to each player, and place the remaining money cards and the solution cards beside the board.
2. **Gameplay:**
   Players roll the dice in turns.
   A roll of six allows them to leave their home base and start traveling around the board and toward a balanced society.
   Players move according to their dice roll, landing on squares that can be good events, bad events, special events or neutral.
3. **Dealing with Challenges:**
   Upon landing on a bad event square, players must choose and buy a solution using their money cards. If they cannot afford a solution, they move backward as specified by the square.
4. **Lucky Break Cards:** These can be used to purchase a solution for a bad event, double the benefits of a good event, or cancel the solution of an opponent's bad event.
5. **Progress:** The game proceeds with players trying to make it around the board, navigating challenges, managing resources, and making strategic decisions towards reaching a balanced society.

# JOURNEY TO A BALANCED SOCIETY

**Instructions for Students**:

- As players representing different countries, your goal is to navigate through global challenges by making informed decisions.
- Utilize your money cards to implement solutions and overcome obstacles on your path. Each decision impacts your progress towards building a balanced society.
- Approach the game with strategic thinking and prudent resource management, aiming to be the first to create a balanced society.
- This game is not only about winning but also about making the right choices for the sustainable development of your country.

# JOURNEY TO A BALANCED SOCIETY

## GOOD & BAD EVENTS

| Square Number | Good Event (15 Squares) | Instruction |
|---|---|---|
| 5 | Economic Boom | Move forward 2 spaces |
| 10 | Technological Breakthrough | Choose: Move forward 3 spaces or move an opponent back 2 spaces |
| 15 | Environmental Grant | Take a free solution card |
| 20 | Social Welfare Improvement | Move forward 1 space |
| 25 | International Aid | Choose: Gain $500,000 or move forward 2 spaces |
| 30 | Renewable Energy Advancement | Move forward 1 space |
| 35 | Successful Policy Implementation | Move forward 2 spaces |
| 40 | Community Development | Choose: Move forward 2 spaces or move an opponent back 1 space |
| 45 | Agricultural Innovation | Gain $100,000 and move forward 1 space |
| 50 | Public Health Improvement | Move forward 2 spaces |
| 60 | Climate Awareness Campaign | Choose: Take a free solution card or move an opponent back 2 spaces |
| 55 | Sustainable Tourism Growth | Choose: Gain $200,000 or switch places with an opponent |
| 58 | Clean Water Initiative | Move forward 3 spaces |

# JOURNEY TO A BALANCED SOCIETY

## GOOD & BAD EVENTS

| Square Number | Bad Event | Instruction | Relevant Solutions |
|---|---|---|---|
| 4 | Hurricane | Buy Solution 7 (stay in place) Buy Solution 14 (move forward 2) No solution (move back 4) | Solution 7: Emergency Preparedness and Educational Campaigns ($10,000) Solution 14: Coastal Protection Initiative ($1,000,000) |
| 8 | Economic Recession | Buy Solution 9 (stay in place) Buy Solution 2 (move forward 1) No solution (move back 5) | Solution 9: Financial Literacy and Aid ($100,000) Solution 2: Economic Stimulus Package ($500,000) |
| 12 | Pollution Crisis | Buy Solution 11 (stay in place) Buy Solution 4 (move forward 2) No solution (move back 6) | Solution 11: Clean Technology Investment ($500,000) Solution 4: Pollution Control Measures ($100,000) |
| 16 | Social Unrest | Buy Solution 13 (stay in place) Buy Solution 6 (move forward 1), No solution (move back 4) | Solution 13: Regulatory Oversight and Tribunal Formation ($200,000) Solution 6: Community Engagement Initiative ($200,000) |
| 19 | Deforestation | Buy Solution 10 (stay in place) Buy Solution 3 (move forward 2) No solution (move back 5) | Solution 10: Urban Green Spaces ($200,000) Solution 3: Reforestation Project ($200,000) |
| 23 | Drought | Buy Solution 12 (stay in place) | Solution 12: Diversified Agriculture ($100,000) |

# JOURNEY TO A BALANCED SOCIETY

## GOOD & BAD EVENTS

| Square Number | Bad Event | Instruction | Relevant Solutions |
|---|---|---|---|
| | | Buy Solution 5 (move forward 1) No solution (move back 3) | Solution 5: Water Conservation Program ($10,000) |
| 27 | Industrial Accident | Buy Solution 7 (stay in place) Buy Solution 14 (move forward 2) No solution (move back 4) | Solution 7: Emergency Preparedness and Educational Campaigns ($10,000) Solution 14: Coastal Protection Initiative ($1,000,000) |
| 31 | Inflation | Buy Solution 9 (stay in place) Buy Solution 2 (move forward 1) No solution (move back 5) | Solution 9: Financial Literacy and Aid ($100,000) Solution 2: Economic Stimulus Package ($500,000) |
| 34 | Biodiversity Loss | Buy Solution 11 (stay in place) Buy Solution 4 (move forward 2) No solution (move back 6) | Solution 11: Clean Technology Investment ($500,000) Solution 4: Pollution Control Measures ($100,000) |
| 38 | Energy Crisis | Buy Solution 13 (stay in place) Buy Solution 6 (move forward 1), No solution (move back 4) | Solution 13: Regulatory Oversight and Tribunal Formation ($200,000) Solution 6: Community Engagement Initiative ($200,000) |
| 41 | Urban Sprawl | Buy Solution 10 (stay in place) Buy Solution 3 (move forward 2) No solution (move back 5) | Solution 10: Urban Green Spaces ($200,000) Solution 3: Reforestation Project ($200,000) |

# JOURNEY TO A BALANCED SOCIETY

## GOOD & BAD EVENTS

| Square Number | Bad Event | Instruction | Relevant Solutions |
|---|---|---|---|
| 44 | Flooding | Buy Solution 12 (stay in place) Buy Solution 5 (move forward 1), No solution (move back 3) | Solution 12: Diversified Agriculture ($100,000) Solution 5: Water Conservation Program ($10,000) |
| 47 | Corruption Scandal | Buy Solution 7 (stay in place), Buy Solution 14 (move forward 2), No solution (move back 4) | Solution 7: Emergency Preparedness and Educational Campaigns ($10,000) Solution 14: Coastal Protection Initiative ($1,000,000) |
| 51 | Unemployment Spike | Buy Solution 9 (stay in place) Buy Solution 2 (move forward 1), No solution (move back 5) | Solution 9: Financial Literacy and Aid ($100,000) Solution 2: Economic Stimulus Package ($500,000) |
| 54 | Extreme Weather Event | Buy Solution 11 (stay in place), Buy Solution 4 (move forward 2), No solution (move back 6) | Solution 11: Clean Technology Investment ($500,000) Solution 4: Pollution Control Measures ($100,000) |
| 59 | Public Health Crisis | Buy Solution 13 (stay in place), Buy Solution 6 (move forward 1) No solution (move back 4) | Solution 13: Regulatory Oversight and Tribunal Formation ($200,000) Solution 6: Community Engagement Initiative ($200,000) |

# JOURNEY TO A BALANCED SOCIETY

## GOOD & BAD EVENTS

| Square Number | Instruction |
|---|---|
| 3 | Take a $ card and move back 2 spaces, or don't and stay in place |
| 18 | Take a free solution card |
| 28 | Swap position with the player in the lead |
| 43 | Take a $ or move an opponent back 3 spaces |
| 56 | Take a $ or move an opponent back 3 spaces |

# GAMES AND INTERACTIVE LEARNING

# SOCIAL MEDIA AWARENESS CAMPAIGN

**Objective:**
To educate students about climate change and nature-based solutions through the development of a social media campaign. This activity aims to enhance understanding, communication, and advocacy skills by engaging students in creating and executing a campaign focused on environmental issues.

**Activity Design for Teachers:**

**Preparation**:

- Choose climate change and Nature-based Solutions topics aligned with the Caribbean Examination Council  curriculum.
- Research examples of effective climate advocacy campaigns.
- List suitable social media platforms for the campaign.

# SOCIAL MEDIA AWARENESS CAMPAIGN

**Instructions for Students:**

1. **Introduction to Climate Advocacy:**
   - Teacher explains the concept and importance of climate advocacy and its global impact.
2. **Developing a Campaign Plan:**
   - Form teams, select a theme, and outline goals, target audience, and key messages.
   - Plan content types and social media strategies for audience engagement.

**Materials Needed:**
- Computers or smartphones, internet access, creative tools.

**Assessment Criteria:**
- Relevance and clarity of campaign goals.
- Creativity and effectiveness of content.
- Impact and engagement level of the campaign.

**Teaching Tips:**
- Focus on creativity, factual messaging, and responsible social media use.
- Provide continuous guidance and feedback.
- Foster teamwork and collaborative learning.

# TEACHER'S GUIDE FOR INTRODUCING CLIMATE ADVOCACY

**Introduction to the Activity:** "Today, we're engaging in a special project to develop a social media campaign about climate change and Nature-based Solutions. This is an opportunity for us to contribute to an important global conversation and make a difference."

**Explaining Climate Advocacy:** "Climate advocacy involves using our influence to promote positive environmental change. It's about educating, pushing for sustainable policies, and protecting our planet. Advocates work to reduce global warming impacts, preserve ecosystems, and ensure a sustainable future. Our collective actions, even small ones, can lead to global change."

**Examples of Climate Advocacy Groups:**
- **Greenpeace:** Known for direct action and global campaigns to reduce environmental harm.
- **World Wildlife Fund (WWF):** Works on wildlife conservation, habitat preservation, and reducing human environmental impact.
- **Sierra Club:** Advocates for clean energy, conservation of natural spaces, and environmental legislation.

"These groups showcase various advocacy methods, from grassroots activism to international campaigns. They are great examples of how we can contribute to environmental protection and sustainability."

# SAMPLE CLIMATE SOCIAL MEDIA CAMPAIGN PLAN FOR STUDENTS

**Campaign Title: "Green Steps For A Blue Planet"**

Objective: To raise awareness about the importance of individual actions in combating climate change and promoting nature-based solutions.
Target Audience: High school students and local community members.
Campaign Duration: 1 month

**Key Messages:**
1. Small actions lead to big changes.
2. The role of nature in combating climate change.
3. How students can contribute to environmental sustainability.

**Content Strategy:**
- Week 1: Launch the campaign with posts about simple daily actions to reduce carbon footprint.
- Week 2: Share infographics on the importance of nature-based solutions like planting trees and preserving wetlands.
- Week 3: Post interviews with local environmental activists or short videos of students undertaking eco-friendly projects.
- Week 4: Encourage community participation in a local clean-up drive or tree-planting event.

**Platforms: Instagram, Facebook, Twitter**
**Engagement Plan:**
- Interactive quizzes on environmental facts.
- Weekly challenges for followers, like a no-plastic week.
- Encourage user-generated content with a specific hashtag.

# SAMPLE CLIMATE SOCIAL MEDIA CAMPAIGN PLAN FOR STUDENTS

**Evaluation:**
- Track engagement through likes, shares, and comments.
- Review the increase in followers and hashtag use.

This plan serves as a template for students to create their own social media campaigns, adapting to their specific contexts and resources.

# GAMES AND INTERACTIVE LEARNING

# Jamaica's Green Future: Urban Planning Simulation

**Objective:**

To engage high school students in Grades 10-11 in an interactive urban planning simulation, emphasizing the importance of integrating green spaces into urban development for environmental sustainability.

**Activity Design for Teachers:**

**Preparation**:

- Prepare materials: large paper sheets (representing land plots), colored pencils, markers, cutouts or stickers of trees, buildings, farms, roads, and water bodies.
- Create a brief guide on urban planning principles, focusing on the integration of green spaces.
- Develop a set of criteria for evaluating the students' urban designs.

# Jamaica's Green Future: Urban Planning Simulation

**Instructions for Students:**

1. **Introduction to Urban Planning:** Introduce the concept of urban planning and its significance in sustainable development and combating climate change.
2. **Designing the Urban Area:**
   - Divide the class into small groups and provide each group with their materials.
   - Instruct them to design an urban area on their plot of land, considering the placement of buildings, roads, farms, and especially green spaces.
   - Emphasize that at least 30% of their land must remain green with parks, forests, green roofs, etc.
3. **Presentation and Discussion:**
   - Have each group present their urban design to the class.
   - Guide them to explain their choices, focusing on their nature-based solutions.
   - Facilitate a discussion with questions like why they positioned green spaces in certain areas and how these spaces help combat climate change.
4. **Reflective Learning:** Conclude with a reflection on the challenges and importance of balancing urban development with environmental preservation.

**Materials Needed:**
- Large paper sheets
- Colored pencils and markers
- Cutouts or stickers of urban elements

**Assessment Criteria:**
- **Design Creativity and Practicality:** How creatively and effectively students incorporate green spaces into their urban design.
- **Understanding of Environmental Concepts:** Knowledge of the role of green spaces in climate change mitigation.
- **Presentation Skills:** Clarity and persuasiveness in presenting their urban design.

**Teaching Tips:**
- Encourage creativity while ensuring that the designs are realistic and practical.
- Provide examples or case studies of urban areas that successfully integrate green spaces.

# Jamaica's Green Future: Urban Planning Simulation

- Use the activity to foster a deeper understanding of how urban planning can contribute to environmental sustainability.

This activity provides a hands-on learning experience in urban planning, allowing students to creatively explore the integration of nature-based solutions in urban settings. It aims to enhance their understanding of sustainable development and the importance of green spaces in combating climate change.

# STEM ACTIVITIES

# STEM ACTIVITIES
# NATURE-BASED SOLUTIONS DESIGN CHALLENGE

**Objective:**

Students will research and design a nature-based solution for a local environmental challenge. This project will integrate science, technology, engineering, and math (STEM) to showcase how nature can provide resilience against climate change impacts.

**Activity Design for Teachers:**

**Preparation:**
- Select relevant local ecosystems and climate change challenges for study.
- Compile a list of design tools and resources.
- Prepare guidelines for model creation and presentations.

# NATURE-BASED SOLUTIONS DESIGN CHALLENGE

**Instructions for Students:**

1. **Research Phase:**

   Study local ecosystems and understand their roles (e.g., carbon sequestration)

   Identify a specific local challenge related to climate change.

2. **Design Phase:**

   Use design software to draft and visualize your solution.

   Consider the application of the solution in the real world.

3. **Prototyping:**

   Create a physical or digital model of your solution.

   Focus on the engineering principles behind your design.

4. **Quantification:**

   Calculate the potential impact of your solution.

   Present your findings using data.

**Materials Needed:**

- Access to design software (Tinkercad, Minecraft, I-tree tool, OR PEN AND PAPER).
- Recycled materials for physical models.
- Computers and internet access for research and design

**Assessment Criteria:**

- Quality of research and understanding of the local ecosystem.
- Creativity and feasibility of the proposed solution.
- Accuracy and clarity of the model or prototype.
- Effectiveness in quantifying the solution's impact.

**Teaching Tips:**

- Encourage collaborative work for diverse perspectives.
- Guide students in using design tools effectively.
- Focus on the practical application of their solutions.
- Facilitate discussions on the broader impact of nature-based solutions

# NATURE-BASED SOLUTIONS DESIGN CHALLENGE SAMPLE STUDENT PROJECT

**Urban Rain Garden**

**Objective:** To design a rain garden as a nature-based solution for reducing urban flooding and improving water quality.

**Research Phase:**
- Students research how rain gardens work, their role in absorbing excess rainwater, and how they help filter pollutants.
- They identify a suitable location in their community, such as a schoolyard or a neighborhood park, where urban runoff is a problem.

**Design Phase:**
- Using basic design tools (like paper sketches or simple digital apps), students outline the layout of the rain garden. This includes the selection of native plants, the shape of the garden, and its size.
- They consider factors like the type of soil, the native plants suitable for the area, and the typical rainfall patterns.

**Prototyping:**
- Students create a small-scale physical model using materials like cardboard, paper, and markers. The model demonstrates the layout of the rain garden and its components.
- They explain how the garden's design, including the depth and choice of plants, will help absorb rainwater and reduce runoff.

**Quantification:**
- Students calculate the approximate area of their rain garden and estimate how much rainwater it could absorb in a typical storm.
- They might also research and discuss the benefits of rain gardens for biodiversity and local ecosystems.

# NATURE-BASED SOLUTIONS DESIGN CHALLENGE SAMPLE STUDENT PROJECT

**Presentation:**
- Students present their rain garden design, showcasing their model, design choices, and the research behind their decisions.
- They explain how their rain garden can address local flooding issues and contribute positively to the environment.

This example project is aligned with the CXC CSEC curriculum on environmental studies and demonstrates a practical application of STEM principles. It is interactive and innovative while being achievable for high school students.

# STEM ACTIVITIES

# HYDROLOGICAL MODELING WORKSHOP

**Objective:**
Students will explore the water cycle through hands-on hydrological modeling. This workshop aims to demonstrate how changes in landscapes, such as deforestation or urbanization, affect local water systems and can lead to environmental issues like flooding, landslides, and erosion.

**Activity Design for Teachers:**

**Preparation:**
- Gather resources on the water cycle and hydrological impacts of landscape changes.
- Research and select user-friendly hydrological software tools like 'HydroDesktop' or 'Visual MODFLOW Flex'.
- Arrange for access to basic hydrological software or online modeling tools.
- Prepare materials for a sandbox terrain model.

# HYDROLOGICAL MODELING WORKSHOP

## Instructions for Students:

1. **Understanding the Water Cycle:**
   - Study the processes of the water cycle: evaporation, condensation, precipitation, and runoff.
   - Discuss how landscape changes affect these processes.

2. **Hydrological Software Exploration:**
   - Utilize 'HydroDesktop' to study water cycle patterns in various landscapes. Observe how changes in land use affect water flow.
   - Experiment with 'Visual MODFLOW Flex' for a more advanced understanding of groundwater movement and interactions.

3. **Physical Model Experiment:**
   - Construct a sandbox terrain model using a large, shallow tray filled with sand to replicate a landscape.
   - Shape the sand to create different terrain features like hills, valleys, and flat areas.
   - Use materials like small twigs or stones to simulate natural and artificial landscape changes (e.g., trees, buildings).
   - Pour water gently over the model to simulate rainfall and observe how the water flows through the landscape.
   - Experiment by changing the landscape (e.g., flattening a hill, adding barriers) and noting differences in water flow.

4. **Data Collection and Analysis:**
   - Measure water volume in different parts of the model.
   - Explain why the watershed approach is crucial for EbA
   - Predict runoff changes due to terrain modifications and compare with actual results.

## Materials Needed:

- Educational materials on the water cycle.
- Computers with hydrological software.
- Sandbox, sand, water, measuring tools, and materials to represent landscape changes (e.g., small plants, rocks).

# HYDROLOGICAL MODELING WORKSHOP

**Assessment Criteria:**
- Understanding of the water cycle and hydrological impacts.
- Accuracy of predictions and data analysis.
- Quality of the physical model and observations.

**Teaching Tips:**
- Encourage teamwork and assign roles for each experiment phase.
- Emphasize the importance of accurate measurements and observations.
- Use the activity to discuss real-world implications and responsible land-use practices.

This workshop offers hands-on experience with both digital and physical models, enhancing students' understanding of hydrology in line with the CXC CSEC curriculum.

# STEM ACTIVITIES
# GREEN VS. GREY INFRASTRUCTURE SHOWDOWN

**Objective:**

To help students in Grades 7-9 understand coastal erosion through the case study of Hellshire Beach in Portmore, Jamaica, and explore the role of mangroves as a nature-based solution.

**Activity Design for Teachers:**

**Preparation:**

• Gather resources about mangroves, permeable pavements, dikes, and impermeable pavements.

• Select simulation software or apps for flood control visualization (e.g., FloodMap or Ansys Water).

• Arrange materials for building miniature models of coastal and urban areas.

# GREEN VS. GREY INFRASTRUCTURE SHOWDOWN

## Instructions for Students:

1. **Scientific Research:**
   - Study how mangroves protect coastlines and how permeable pavements reduce runoff.
   - Investigate the impacts and longevity of grey infrastructure like dikes.
2. **Simulation Exercises:**
   - Use software to simulate flood scenarios and compare the effectiveness of green vs. grey infrastructure.
3. **Model Construction and Testing:**
   - Build miniature models representing coastal and urban areas.
   - Implement green and grey infrastructure solutions in these models.
   - Conduct controlled water flow experiments to test effectiveness.
4. **Economic Analysis:**
   - Calculate the cost-effectiveness and Return on Investment of each infrastructure type using Net Present Value or Benefit-Cost Ratio
   - Consider long-term factors like climate change in your analysis.

## Materials Needed:
- Educational materials on green and grey infrastructure.
- Access to simulation software.
- Materials for model construction (cardboard, sand, small plants, etc.).

## Assessment Criteria:
- Depth and accuracy of ecological and economic research.
- Effectiveness in using simulations and conducting physical tests.
- Quality of the final proposal, including rationale and calculations.

## Teaching Tips:
- Encourage collaborative learning and group discussion.
- Provide guidance on using simulation tools and building models.
- Facilitate reflection on the advantages and limitations of each infrastructure type.

# MODEL CONSTRUCTION AND TESTING INSTRUCTIONS FOR "GREEN VS. GREY INFRASTRUCTURE SHOWDOWN"

**Building Miniature Models:**

1. **Creating the Base:**
   - Use a large, shallow tray or a similar container to build your model. This will serve as the base for both coastal and urban landscapes.
   - Fill part of the tray with sand to create a coastal area. The other part can be left flat to represent an urban setting.

2. **Implementing Infrastructure:**
   - Green Infrastructure for Coastal Area: Plant small mangrove seedlings or use artificial plants to simulate mangroves along the sandy coastline.
   - Grey Infrastructure for Coastal Area: Build small dikes using clay or LEGO bricks along a different section of the coastline.
   - Green Infrastructure for Urban Area: Create permeable pavements using sponge pieces to represent areas that absorb water.
   - Grey Infrastructure for Urban Area: Use plastic sheets or tiles to represent impermeable pavements.

**Conducting Water Flow Experiments:**

1. **Simulating Rainfall and Storm Surges:**
   - Use a watering can to simulate rainfall over the urban area. Observe how water interacts with both permeable and impermeable surfaces.
   - Gently pour water against the coastal models to mimic a storm surge. Observe the effectiveness of mangroves and dikes in preventing erosion and reducing wave impact.

2. **Observation and Data Collection:**
   - Record observations on how quickly water is absorbed or how effectively it is blocked in different sections of the model.
   - Measure any water overflow or the distance water travels in each scenario.

# MODEL CONSTRUCTION AND TESTING INSTRUCTIONS FOR "GREEN VS. GREY INFRASTRUCTURE SHOWDOWN"

3. **Analysis:**
   - Discuss the effectiveness of green versus grey infrastructure based on your observations.
   - Consider the practicality of each solution in real-life scenarios.

## STEM ACTIVITIES

# DESIGN AND BUILD A SUSTAINABLE HOME MODEL

**Objective:**
For high school students in Grades 10-11 to design and build a model of a sustainable home, emphasizing the use of renewable resources and minimizing energy consumption. This activity challenges students to innovate structures that adapt to and positively contribute to the environment, using nature-based solutions.

**Activity Design for Teachers:**

**Preparation:**
- Compile resources on sustainable building materials, energy-efficient home designs, and renewable energy sources.
- Gather materials for model building, such as cardboard, recycled materials, fabric, and craft supplies.
- Prepare a basic template for designing the home layout and guidelines for incorporating sustainable features.

# DESIGN AND BUILD A SUSTAINABLE HOME MODEL

**Instructions for Students:**

1. **Introduction to Sustainable Home Concepts:**
   - Discuss the principles of sustainable architecture, focusing on energy efficiency, use of renewable resources, and minimizing environmental impact.

2. **Research and Design Phase:**
   - Instruct students to research various sustainable home features like solar panels, green roofs, rainwater harvesting systems, and efficient insulation.
   - Guide them to design their sustainable home on paper, planning the layout and integrating the researched sustainable features.

3. **Model Building:**
   - Provide students with materials to build a physical model of their designed sustainable home.
   - Encourage creativity in using recycled or eco-friendly materials to construct their models.

4. **Sustainability Calculations:**
   - Have students estimate the energy efficiency of their design, potential water savings, and overall environmental impact.
   - Guide them in calculating cost-effective solutions and potential energy savings.

5. **Presentation and Peer Review:**
   - Organize a session where students present their sustainable home models to the class.
   - Encourage peer review, where students discuss the sustainability features and effectiveness of each design.

6. **Reflection:**
   - Conclude with a reflection on the importance of sustainable living and how architectural design can contribute to environmental conservation.

**Materials Needed:**
- Drawing and design materials (paper, pencils, rulers)
- Model building supplies (cardboard, recycled materials, craft supplies)
- Research resources on sustainable home features

# DESIGN AND BUILD A SUSTAINABLE HOME MODEL

**Assessment Criteria:**
- Design Creativity and Practicality: How creatively and effectively students incorporate sustainability into their home design.
- Model Quality: Craftsmanship and representation of sustainable features in the model.
- Understanding of Sustainable Concepts: Depth of knowledge demonstrated in the design and presentation.
- Engagement and Collaboration: Active participation in the building process and peer review sessions.

**Teaching Tips:**
- Provide clear instructions on the expectations for the home design and model building.
- Encourage students to think about local environmental conditions and how homes can be adapted to these.
- Use this activity to foster skills in research, design, and hands-on creativity, while emphasizing the importance of sustainable living practices.

This project offers a hands-on learning experience for students, allowing them to creatively explore sustainable architecture and its role in addressing climate change challenges. It promotes critical thinking and problem-solving in a real-world context.

# DESIGN AND BUILD A SUSTAINABLE HOME MODEL

GRADE 10-11

# RESOURCES AND REFERENCES

1. https://en.unesco.org/themes/education/sdgs/material/13
2. https://unccelearn.org/
3. https://www.unesco.org/en/node/66349
4. https://unric.org/pt/wp-content/uploads/sites/15/2020/01/educationalresources-eng.pdf
5. https://unfccc.int/topics/education-and-outreach/resources/materials-on-education-and-training
6. https://www.un.org/sustainabledevelopment/student-resources/
7. https://www.bbc.co.uk/news/science-environment-24021772
8. https://www.bloomberg.com/graphics/2015-whats-warming-the-world/
9. https://climatekids.nasa.gov/
10. https://www.cfr.org/backgrounder/envisioning-green-new-deal-global-comparison?utm_source=academic&utm_medium=email&utm_campaign=CFRAcademicClimate21Apr2020&utm_term=AcademicBulletin
11. https://gpm.nasa.gov/education/websites/global-climate-change-vital-signs-planet
12. https://www.gcedclearinghouse.org/sites/default/files/resources/Teachers%27%20guide%20for%20education%20for%20sustainable%20development%20in%20the%20Caribbean.pdf
13. https://kids.nationalgeographic.com/
14. https://www.mona.uwi.edu/physics/csgm/climate-resources
15. https://mysteryscience.com/
16. https://ourworldindata.org/co2-and-greenhouse-gas-emissions
17. https://se-ed.org.uk/Users/jamie/Downloads/climate-literacy-highres.pdf
18. https://www.worldwildlife.org/videos/wwf-together-app
19. [https://world101.cfr.org/global-era-issues/climate-change?utm_source=academic&utm_medium=email&utm_campaign=CFRAcademicClimate21Apr2020
20. (https://world101.cfr.org/global-era-issues/climate-change?utm_source=academic&utm_medium=email&utm_campaign=CFRAcademicClimate21Apr2020&utm_term=AcademicBulletin)