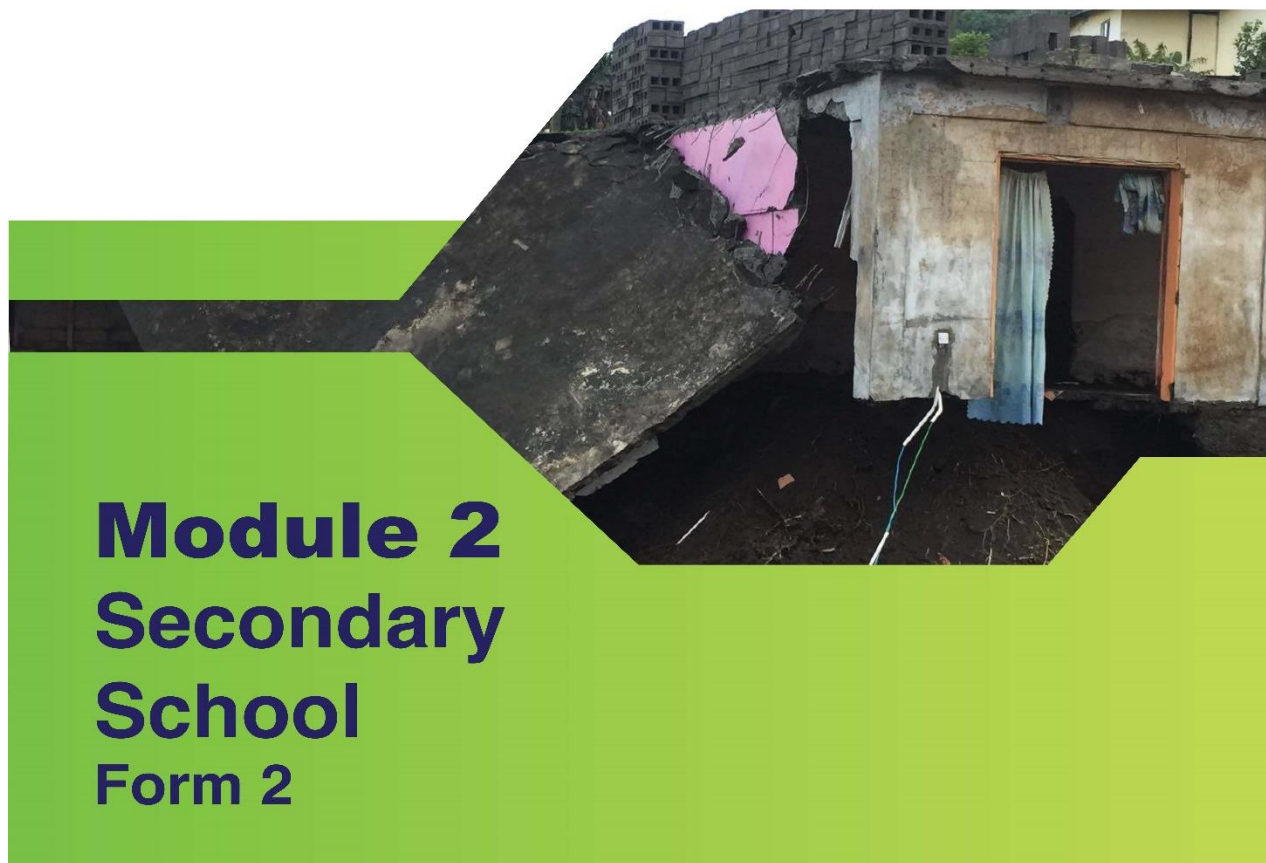




National Curriculum Development in Climate Change Mitigation and
Adaptation and Disaster Risk Reduction
St. Vincent and the Grenadines



Module 2
Secondary
School
Form 2

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For Government St. Vincent and the Grenadines
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Strand 1: Hazard and Disasters

Unit 1: Hazards and Disasters

Topic 1: What Turns a Hazard Into a Disaster?

Activity 1: Hazard, Vulnerability and Capacity Interactions

Purpose: Understanding the dynamic relationships between hazard, vulnerability and capacity which determine the level of disaster risk

Time needed: 45 minutes

Resources needed

- A cut-up set of the *Hazard, Vulnerability and Capacity* colour cards per class
- A copy of the *Degree of Disaster Risk* handout per student
- Open space in the classroom
- Pencils

Procedure

Step 1: Ask students to stand in an open area in the classroom. Give each student one of the colour cards and a copy of the *Degree of Disaster Risk* handout. Explain that they are creating a group of three, with students having different colour cards. When they get together, ask them to fill in the first section of the handout writing down what is on each colour card, and then discuss the level of disaster risk by ticking the appropriate box. Once completed, give a signal and ask them to repeat the same process. Keep repeating the process until they complete the handout. (20 minutes)

Step 2: Hold a whole-class discussion. Focusing on one specific hazard card at a time, invite students to share when disaster risk becomes high and becomes low and what factors influence the degree of disaster risk. (15 minutes).

Step 3: As a summary, explain the disaster risk reduction formula by drawing upon the information *in Box 1*. Invite questions. (10 minutes)

Box 1

$$\text{Disaster risk} = \frac{\text{Hazard} \times \text{Vulnerabilities}}{\text{Capacity}}$$

- Disaster risk is the potential disaster loss in lives, health status, livelihoods, assets and services that can be incurred by a particular community or a society over some specified future time period
- A hazard is an event with the potential to cause harm
- A disaster happens when the hazard exceeds people's and community's capacity to cope to devastating effect
- The level of disaster risk is influenced by prevailing conditions and extent of vulnerability

- The level of disaster risk is reduced by increasing the capacity of a society

Source: UNISDR Terminology; Selby & Kagawa. (2014). *Disaster Risk Reduction Education Toolkit*.

Variation

Divide the class into three groups and give each group a different set of colour cards. Ask one person from each colour group to pick up one card and come forward and read it out in turn. Have them discuss the level of disaster risk. Ask a new person from each group to pick up a card from their pile and repeat this procedure. Repeat this a few times. Have students take notes in their *Degree of Disaster Risk* handout.

Potential/Facilitation Tips

This activity will help students clearly understand that hazard and disaster are different. Interactions between the three colour cards - each representing an essential component from the disaster risk formula (i.e., blue for hazard, yellow for vulnerability, green for capacity) - illuminates how a change in one of these can affect the level of disaster risk. Keep the disaster formula in mind and always point out that reducing vulnerability and increasing capacity is essential in disaster risk reduction. It is also important to point out that adaptive capacity needs to evolve in relation to the rapidly changing nature of hazards (especially climatological or meteorological hazards).

At an appropriate point in *Step 2*, students develop a concrete example and add an additional card(s) in the formula. For instance, add a 'tsunami' card' after an 'earthquake magnitude 6' card. How does this affect the level of disaster risk? If they add more vulnerability card(s) or more capacity card(s), how would that affect the level of disaster risk?

Curriculum Links

This activity can be used to complement the Life Science and Earth Science strands of the Form 2 Integrated Science and Technology curriculum. The former strand includes an achievement indicator calling on students to 'examine the impact of human activity on the environment.' For the latter, students are expected to look at interrelationships within ecosystems and examine how climate change affects those relationships.

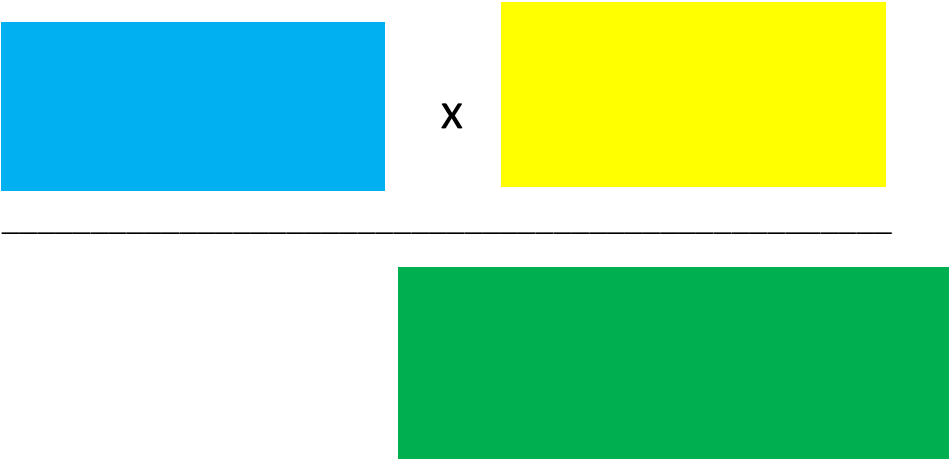
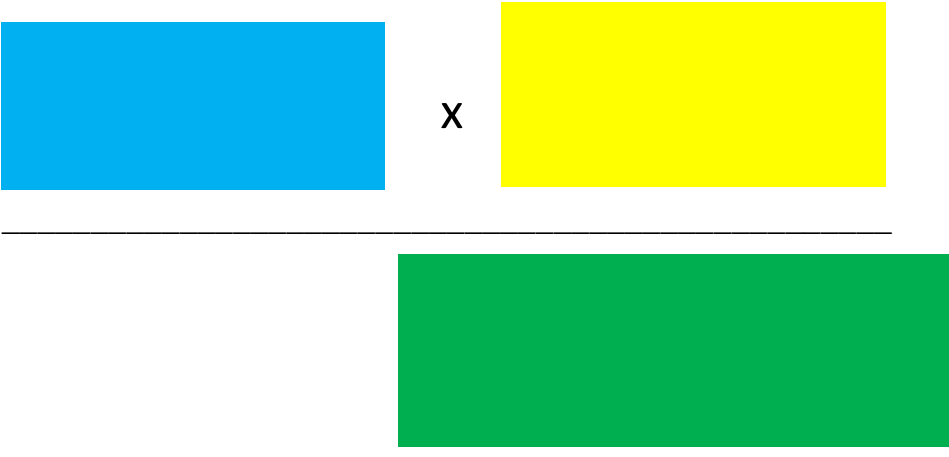
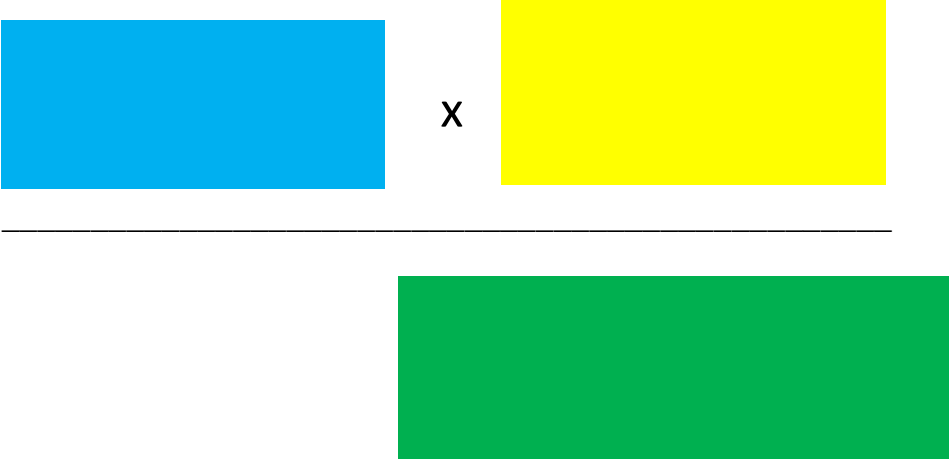
Handout: Colour Hazard, Vulnerability and Capacity Cards

Hurricane (category 2)	Hurricane (category 5)	Flash flooding
Earthquake (magnitude 2)	Earthquakes (magnitude 5)	Tsunami
Drought	Volcanic eruption	Dengue epidemic

Living in an urban slum	Living in a coastal area	The very elderly
The very young	People with moving impairment	Ethnic minority group in a remote area
House built following the SVG government building codes	Very weak and old house	Living in an environmentally degraded area

Having a family emergency plan	Conducting regular evacuation drills	Early warning systems in place in the community
Having a basic family first aid kit and other emergency equipment	Being trained for disaster preparedness	House built following the SVG government building code
Knowledge of what to do when a hazard strikes	Family with financial resources and house insurance	Strong mutual-help ethos in the community

Handout: Degrees of Disaster Risk

<p>1</p>  <p>• High disaster risk • Medium disaster risk • Low disaster risk</p>
<p>2</p>  <p>• High disaster risk • Medium disaster risk • Low disaster risk</p>
<p>3</p>  <p>• High disaster risk • Medium disaster risk • Low disaster risk</p>

4

X

• High disaster risk
• Medium disaster risk
• Low disaster risk

5

X

• High disaster risk
• Medium disaster risk
• Low disaster risk

6

X

• High disaster risk
• Medium disaster risk
• Low disaster risk

Strand 1: Hazard and Disasters
Unit 1: Hazards and Disasters
Topic 2: Slow and Rapid Onset Disasters

Activity 2: Slow Onset Hazards

Purpose: Categorizing types of hazards, examining key characteristics of slow-onset hazards and considering prevention and mitigation actions to address them

Time needed: 70 minutes

Resources needed

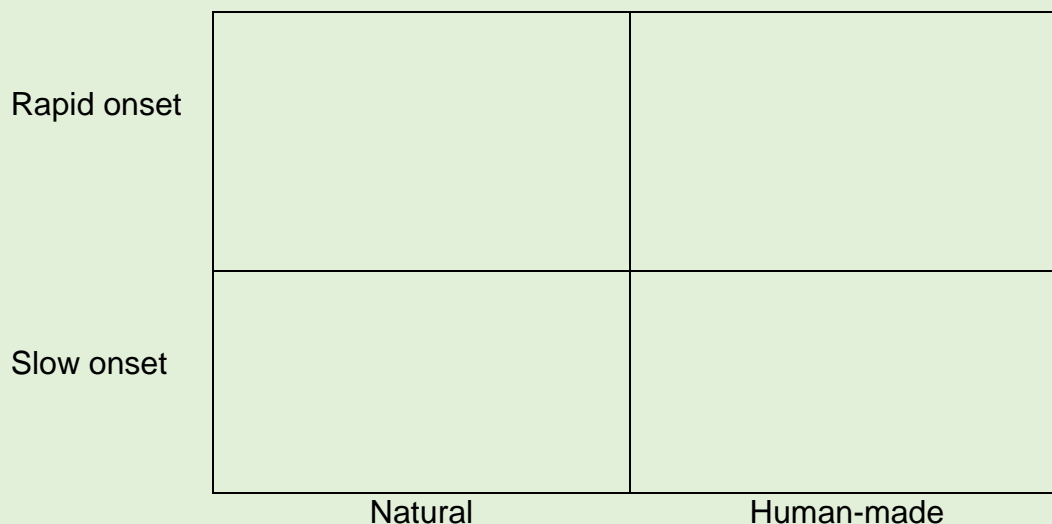
- A set of cut-up hazard cards per group of five
- A set of cut-up SVG slow-onset hazard cards per class
- A sheet of chart paper and a glue stick per group

Procedure

Stage 1: Hazard Typology

Step 1: Ask students to form groups of five. Distribute a set of hazard cards, a sheet of chart paper, a marker and a glue stick. Draw the diagram (see *Box 2*) on the board and ask each group to copy it onto their chart paper.

Box 2: Types of Hazards



Go on to explain that their task is to place each hazard card in the appropriate section of the diagram. For instance, an 'earthquake' card would be placed in the top left place for a 'rapid onset' and 'natural' hazard. Say that if they consider a hazard of both rapid onset or slow onset depending on the situation, the card should be placed on the line between the two sections. Explain, too, that if they think a hazard can be

natural or human-made depending on the situation, the card should be placed on the line between the two sections. (10 minutes)

Step 2: Put two groups together and have them compare and contrast each other's work. (10 minutes)

Step 3: Ask each group to report back what they have noticed, focusing on the differences between the two groups. Then hold a whole-class discussion. (10 minutes)

Stage 2: Slow Onset Hazards in SVG

Step 1: Point out that there is a general tendency for slow-onset hazards to be less prioritized than rapid onset hazards in the field of disaster risk management—brainstorm why this is the case. Draw upon the information from *Box 3* as appropriate as the class considers what has been brainstormed. (10 minutes)

Box 3

- A rapid onset hazard may be a single, discrete event that occurs in a matter of days or even hours, whereas slow onset hazards evolve gradually with incremental changes occurring over many years with increased frequency or intensity of recurring events
- Responses to fast onset hazards are usually regulated through emergency management plans at national and sub-national levels
- While the relatively slow evolution of slow onset hazards gives the opportunity to prepare appropriate responses, the perceived lack of urgency combined with their low visibility and stealthy nature means that they often go unnoticed and creep up on a community
- Slow onset hazards are happening around the world, some such as climate change with global effect. The loss of arable and habitable land and safe and clean water slowly force people to move away from their home and livelihood.

Sources: OHCA. 2011. OCHA and Slow-Onset Emergencies; UNFCCC. 2012. *Slow Onset Events: Technical Paper*.

Step 2: Divide students into four groups. Give each group one of the SVG slow onset hazard cards, chart paper, and markers. Explain that their task is to consider the following two questions: (1) What might turn this hazard into a disaster? (2) What can be done individually and collectively to prevent and/or mitigate the hazard's impact in question? (15 minutes)

Step 3: Invite each group to present their work and encourage others to give constructive comments and additional suggestions. (15 minutes)

Extensions

1. Have each group investigate what has been done to prevent and mitigate the impact of the hazard they have considered. This activity could be done by Internet search or interviewing people who know the situation well.
2. Have students gather SVG-specific examples of slow-onset hazards through newspapers and Internet searches at home. Then, focusing on one specific slow-onset hazard example, have them investigate what has been done to prevent/mitigate its impacts and/or consider what should be done. Give space for them to share their findings.

Potential/Facilitation Tips

Further to *Activity 1*, it is crucial to distinguish the terms ‘hazard’ and ‘disaster’ in this lesson: they are not the same, vulnerabilities and lack of capacity turning a hazard into a disaster.

In *Stage 1 Step 3* discussion, point out that division between ‘slow’ and ‘fast’ onset is not always clear-cut. For instance, some volcanic eruptions may be preceded by weeks or months of activity, while the actual eruption may occur within days or hours. Speed of flooding can also muddy the difference. Flash flooding often arrives without warning, occurring shortly after the onset of very heavy rain. Riverine floods occur when water levels rise above the river banks, with the flooding taking some time.

Curriculum Links

This activity can be aligned with the Life Science and Earth Science strands of the Form 2 Integrated Science and Technology curriculum. The former strand includes an achievement indicator calling on students to ‘examine the impact of human activity on the environment.’ For the latter, students are expected to look at interrelationships within ecosystems and examine how climate change affects those relationships.

Hazard Cards

Earthquake	Drought	Flooding
Bushfire	House fire	Hurricane
Volcanic eruption	Tsunami	Traffic accident
Air Pollution	Environmental degradation	Sea level rise
Coastal erosion	Epidemic	Loss of biodiversity
Civil unrest	Terrorist attack	Climate change

Handout: SVG Slow Onset Disaster Card

<p>Drought</p> <p>In 2010 the residents of Bequia experienced a ten-month drought and were forced to reply on emergency water deliveries from the mainland of St. Vincent.</p> <p>While the prolonged drought of 2010 eventually broke after ten months, the community faced similar conditions in the years following.</p>	<p>Environmental Degradation</p> <p>Sand mining in St. Vincent and the Grenadines is causing severe environmental damage. The coastal erosion in Brighton is terrible. Huge sand dunes have been removed, and a once beautiful and idyllic coastline has been disfigured. The once fertile lands nearby have been rendered uncultivable. Giant bulldozers and heavy machines have overrun a turtle and bird sanctuary.</p>
<p>Marine Pollution</p> <p>Despite the regular waste collection system by the Solid Management Unit of the Central Water and Sewerage Authority (CWSA), illegal dumping in St. Vincent and the Grenadines has gotten worse over the years.</p> <p>Marine pollution in SVG primarily results from illegal land-based dumping and littering, increased nutrients from grey water, fertilizers and sedimentation. Runoff from watersheds was the major source of pollution identified in the Grenadines islands.</p>	<p>Coastal Erosion and Sea Level Rise</p> <p>After years of erosion by the waves and rising sea levels, Mayreau is confronted with the real possibility that the sea will split the island into two, destroying its world-famous Salt Whistle Bay, a great visitor attraction.</p> <p>At its widest part, the land that separates the waters of the Caribbean Sea from the Atlantic Ocean, on Windward Carenage Bay, is now only about 20 feet.</p>

Sources: Sand Mining in Brighton: A Blot on Government's Record. <http://thevincentian.com/sand-mining-in-brighton-a-blot-on-governments-record-p13174-133.htm>; Chance, K. The Caribbean Island of Mayreau Could Be Split in Two Thanks to Erosion. <http://www.ipsnews.net/2018/11/caribbean-island-mayreau-split-two-thanks-erosion/>

Strand 1 Hazard and Disasters
Unit 1 Hazards and Disasters
Topic 3 Intermediate First Aid (including CPR)

Activity 3: Cardiopulmonary Resuscitation (CPR)

Purpose: Understanding the importance of life-saving techniques such as Cardiopulmonary Resuscitation (CPR); understanding how to perform CPR on an adult, and developing increased confidence in providing lifesaving support in an emergency.

Time needed: 95 minutes

Resources needed

- A copy of *Descima Hamilton: One Person in Each Home Should Learn CPR*
- A sheet of chart paper and colour markers per group of four students
- CPR Procedure video, for instance: How to Perform CPR - New Zealand Red Cross: <https://www.youtube.com/watch?v=bEBEOuaQcag> (1.35 minutes)
- Computer(s) with Internet access
- Invited SVG Red Cross speaker

Procedure

Stage 1: CPR Introduction

Step 1: Have students form groups of four and give each group a copy of the newspaper article, *Descima Hamilton: One Person in Each Home Should Learn CPR*, a sheet of chart paper and colour markers. Explain that their task after reading the article together is to discuss and write down the following: (1) things with which they most agree with Descima Hamilton and why; (2) things with which they least agree with her and why; and (3) questions they have. (10 minutes)

Step 2: Invite groups to report back on what they have discussed, jotting down key questions on the board. Emphasize the importance of first aid, including CPR drawing on the information in *Box 4* at an appropriate point. (15 minutes)

Box 4

Every year, millions of people are hurt or killed by injuries due to an inadequate response or lack of timely assistance. Yet, taking immediate action and applying the appropriate techniques, while waiting for professional help, can considerably reduce deaths and injuries and the impact of disasters and everyday emergencies. First aid is therefore a humanitarian act that should be accessible to all.

Source: IFRC Thai Red Cross Society. *Training youth volunteers in cardiopulmonary resuscitation & choking first aid.*

Step 3: Show a basic CPR procedure video clip. Repeat the video more than once.

Have students return to the same groups formed for *Step 1* and prepare five questions they would like to ask a SVG Red Cross guest speaker scheduled to visit the class. (10 minutes)

Stage 2: CPR Demonstration and Practice

Step 1: Welcome the SVG Red Cross visitor to the class and introduce her/him to students. Ask the guest to demonstrate CPR procedures, give practical tips and provide opportunities for students to practice some key aspects of CPR. (40 minutes)

Step 2: Encourage students to put questions to the guest speaker. The questions can be drawn from those they prepared or those spontaneously triggered by what they have heard and observed. (20 minutes)

Potential/Facilitation Tips

The classroom teacher needs to arrange for a SVG Red Cross officer to visit well in advance through the SVG Red Cross office. Ask the guest speaker to make the session very practical and engaging by, for instance, using dolls or manikins to demonstrate the steps for basic life support for both a child and an adult. Consulting with the guest speaker in advance, arrange the classroom environment to their requirements (e.g., creating a large open space for practical work with the manikins/dolls).

Stage 1 intends to raise student awareness of CPR before the Red Cross guest speaker's visit. Having their questions formulated before the session with the guest speaker will help students become more attentive to the speaker's presentation.

Curriculum Links

This activity complements the 'Health Promotion' theme of Year 2 of the Health and Family Life Education curriculum, which requires students to 'recognize the adverse consequences of health that result from not protecting the environment or themselves from environmental hazards' and the 'Disaster Preparedness' theme that deals with learning about life-saving CPR skills.

Handout

Descima Hamilton: One Person in Each Home Should Learn CPR

'The need for at least one person in every household to have some knowledge of Cardiopulmonary Resuscitation (CPR) is of paramount importance', said Descima Hamilton, longstanding member of the St. Vincent and the Grenadines Red Cross Society.

Hamilton, one of the Society's First Aid and CPR instructors, speaking in the wake of Monday's drowning death at Rawacou, said, 'Most persons do not see the need for these skills unless an emergency hits close to home. You cannot predict an emergency. First Aid and CPR should be a personal desire that every adult should strive for because we know emergencies don't tell you when they are coming.'

CPR involves a physical intervention to create artificial circulation through rhythmic pressing on the chest of the patient to manually pump blood through the heart, and usually also involves ventilating the lungs to pass oxygen into the blood in a process called Artificial Respiration.

Hamilton said, 'In many tragedies similar to Monday's, had persons been not only aware of the proper procedure, but also confident enough, lives may have been saved. Some people are afraid to respond to emergencies because they do not want to be held responsible if something goes wrong. One of the first things we teach when training in First Aid and CPR is that you have to be confident.'

The principal of the Dr. J P Eustace Memorial Secondary School indicated that First Aid and CPR training is available at the Red Cross Society for individuals, groups and business places that are interested in learning the skills.

'Interested persons and groups can contact the local Red Cross Society and arrange for these courses' which, Hamilton said, 'will be facilitated by competent instructors with the use of modern training aids.'

'However', she said, 'persons shy away from the training because of the cost', which in her opinion cannot be compared to life saving techniques which will last a lifetime.

'These skills are particularly easy to learn', Hamilton said. 'It is a skill that at least one person per household should have, and teach to other members of their family.'

Hamilton, however, noted that when a person becomes a volunteer and member of the society, the CPR and First Aid training is free of cost.

Recently, the local Red Cross Society made an appeal for more persons to become Red Cross volunteers in the wake of the magnitude 7.0 earthquake that struck Haiti

Source: Adapted from *Searchlight*, *Hamilton: One Person in Each Home Should Learn CPR*. April 9, 2010. <https://searchlight.vc/searchlight/news/2010/04/09/hamilton-one-person-in-each-home-should-learn-cpr/>

Strand 2: Climate change
Unit 2: Climate change: Impacts and Responses
Topic 1: Local Impacts

Activity 4: Building Consequence Chains

Purpose: Recapping the causes of climate change, exploring the local impact of climate change and reflecting on the knock-on effects of these impacts.

Time needed: 75 minutes (10 minutes for Stage 1; 20 minutes for Stage 2; 45 minutes for stage 3)

Resources needed:

- *Handout: Greenhouse Effect Words:* one per group of three or write the words on the board so everyone in the class can see them
- *Handout: Birth Month Weather:* twelve copies or blank pieces of paper
- *Handout: Climate Change Impacts in SVG:* twelve copies
- Large sheet of chart paper and two markers of different colours for each group of three or four students
- Pins and/or adhesive tape

Procedure

Stage 1

Step 1: Give out the Greenhouse Effect Words sheet, one per group of three or put all the words on the board at the front so all the class can see them. In their groups of three, have students group the words into sets of three, putting together words that they think go together. Have each group explain why they have grouped the words as they have. Use the student's explanations of their groupings to correct any misconceptions and highlight the causes and consequences of the greenhouse effect and climate change. (10 minutes)

Stage 2

Step 1: Have the class order themselves by birth month. Working with others who share their birth months, ask them to consider the weather during their birth month consider temperature, precipitation and extreme weather events. Have students discuss whether there have been any changes in climate relating to their birth month. They could use the Birth Month Weather handout table to record their discussion, looking here at the first and second row. (10 minutes)

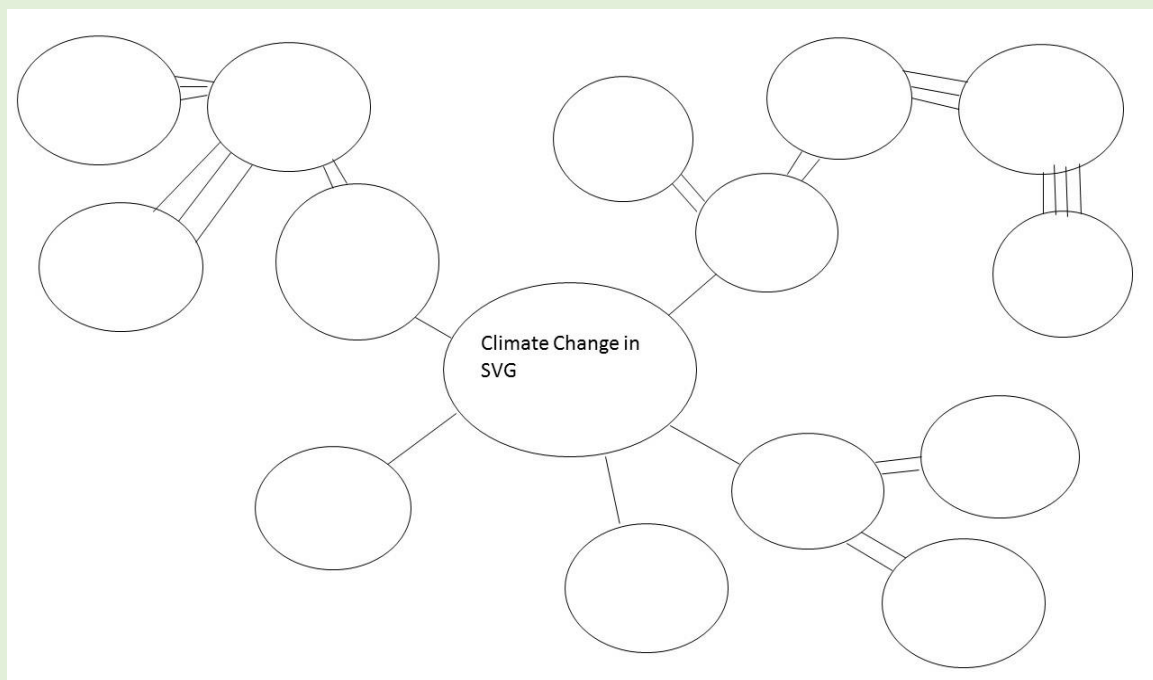
Step 2: Give out or read out the handout *Climate Change Impacts in SVG* taken from *Case Study 1* in the *Resource Manual*. In their groups, have students discuss: What changes are recorded and predicted due to climate change relating to their birth month? How does their birth month compare to yearly averages? Are there any hazards that are of particular concern during their birth month? How does climate

change impact these, if at all? Students could use rows 3 and 4 of the Birth Month Weather handout to record their discussion. Starting with January, ask each group to describe the impact of climate change on the climate and the potential hazards during their birth month. (10 minutes)

Stage 3

Step 1: Have students form groups of three or four and distribute the chart paper and markers. Demonstrate the *Futures Wheel Diagram* (see *Box 5*) on the flip chart or chalkboard and explain the futures wheel activity process as one of exploring first-, second-, third-, fourth- and, possible, fifth-order consequences of an issue event or trend. Ask groups to write the words 'Climate Change in St. Vincent and the Grenadines' in the sheet's center and draw a circle around the words. They should use only one colour marker. (5 minutes)

Box 5: Futures Wheel Diagram



Step 2: Ask groups to consider likely concrete effects of climate change in St. Vincent and the Grenadines using the previous activity as a guide. Draw single lines radiating out from the central circle, write in each of the effects they have thought of, and draw a circle around each. (5 minutes)

Step 3: Have them then consider the possible repercussions from the first set of consequences (the first-order consequences). This time they draw double lines radiating out to one or more second-order consequences arising from each first-order consequence. Encourage them to go on and write in and circle third-, fourth- and even fifth-order consequences. Ask them to consider the impact of climate change effects on agriculture, energy, eco-systems, tourism and human health. (10 minutes)

Step 4: Ask groups to consider how different consequences might work together to amplify the consequences for human communities and the severity of climate change. The consequences should be linked by drawing a two-way arrow between the consequences concerned, with an explanation written in. For this, the second colour marker should be used. (5 minutes)

Step 5: Ask students to identify which consequences are most significant for themselves. (5 minutes)

Step 6: Have groups hang their charts on the classroom wall or pinboard and invite everyone to read the work of other groups. (5 minutes)

Step 7: Lead a whole group debriefing discussion. (10 minutes)

Potential/Facilitation Tips:

Stage 1 is a recapping exercise, revising the greenhouse effect and the causes of climate change. There is no one correct way of grouping the words, but the discussion generated by this task should enable students to share what they can remember about climate change. Use the class discussion to correct any misconceptions.

Stage 2 enables students to consider the recorded and predicted impacts of climate change in SVG, brainstorming how the changes might break down by month and the impact of climate change on the risk from hazards. While the handout does not provide detailed information, students can use their own experiences, anecdotes and stories, together with the information provided, to consider the impact of the changes predicted.

In *Stage 3*, the futures wheel device helps show how immediate consequences of climate change will themselves trigger a range of knock-on effects. The linking stage of the activity will show how various combinations of consequences can exacerbate the climate change threat; also how combinations of consequences can themselves become key drivers in accelerating climate change. You might focus on the following in the debriefing discussion (*Step 7*): differences in group presentations (interpretations, emphases, omissions); the problematic nature of forecasting climate

change given the variables, unknowns and uncertainties of complex systems; in particular, forecasting local manifestations; interrelationships between consequences that students felt other groups had overlooked; why some consequences could be particularly significant for individuals.

Curriculum Links:

This activity falls under Form 2 Health and Family Life Education, Strand 4 'Managing the Environment'; in particular the theme of 'Health Promotion' under which the achievement indicators include: 'list common or familiar things in the environment that can potentially affect life and health and are classified as hazardous' and 'identify common hazards which man creates and which can damage either his health and or the environment.' It also falls under Form 2 Health and Family Life Education Strand 4 'Managing the Environment' in particular the theme of 'Disaster Preparedness' under which the achievement indicators include: 'conduct research on the economic cost of natural disasters'; 'show understanding of how natural disasters impact on the health care system;' 'examine the effects of natural disasters on families and relationships' and 'discuss the emotional implications of natural disasters.' This activity would provide a good introduction or conclusion to this aspect of the curriculum.

Sources: Adapted from: Oberman. (2016). *Creating Futures*. Dublin: Trocaire/Centre for Human Rights and Citizenship Education, Dublin City University; Red Cross/Red Crescent Climate Centre (Undated). *Y-Adapt: Youth Action on Developing Adaptation Plans for Tomorrow* and Selby and Kagawa (2014). *Disaster Risk Reduction Education Toolkit*. (St Michael: CDEMA).

Handout: Greenhouse Effect Words

Coal	Oil	Gas
Carbon dioxide	nitrous oxide	Methane
Fossil fuels	Greenhouse gases	Driving a car
Greenhouse	Atmosphere	Blanket
Humans	Power stations	Trees
Seas	Ice caps	Sun

Handout: Birth Month Weather

Birth Month: _____

	Temperature	Precipitation	Extreme Weather Events	Potential Hazards
Current Observations				
Changes observed by Students				
Recorded Changes				
Predicted Changes				

Handout: Climate Change Impacts in St. Vincent and the Grenadines

St. Vincent and the Grenadines is a small country that is highly vulnerable to adverse climate change influences. Some of the impacts of climate change are already experienced through damage caused by severe and extreme weather events and through gradual changes in temperature and rainfall patterns.

Temperature

The mean annual temperature has increased by 0.7°C since 1960, at an average rate of 0.16 °C per decade and this warming has affected all seasons equally. For the period from 1901 to 2016, mean annual temperature is recorded as 26.7°C.

Temperatures are expected to increase between 0.6 and 2.3 °C by the 2060s and between 1.1 to 3.9°C by the 2090s. The projected rate of warming is spread throughout the year, but more rapid in the south than the north. The number of hot days and nights are projected to increase significantly throughout the country by the 2060s. The number of cold days and nights is projected to decrease significantly.

Precipitation

Main rainfall occurs between May and October and averages around 150-200 mm rainfall per month. Average precipitation has shown a decrease of 8.2 mm (-5.7%) per decade in the period from 1960 to 2006, affecting all seasons but most significantly the wet season from June to November. The average decline has been 10.6 to 13.5 mm per month (4.9% to 7.1%) per decade.

Projections indicate decreases in rainfall occurring mostly during the June to November period by the 2090s from 1970 to 1999 baselines, and more so in the south than in the north.

Tropical Storms and Hurricanes

North Atlantic hurricanes and tropical storms appear to have increased in intensity over the last three decades. Observed and projected increases in sea surface temperatures suggest the potential for continuing increases in hurricane activity. It is projected that storms and hurricanes will increase in intensity but not necessarily in frequency.

Sea Level Rise

Sea level rise in the Caribbean is expected to be near the global mean, although it is not presently possible to project specific sea level rise for SVG. Model-based projections of global mean rise (relative to 1986-2005) suggest an indicative range of 0.26 to 0.77m by 2100 for 1.5°C of global warming. Sea level rise will continue beyond 2100 even if global warming is limited to 1.5°C in the 21st century.

In the recent studies examining rapid ice sheet melt (Greenland and Antarctic) there is an emerging consensus that sea level rise by the end of the 21st century will be between 1-2 m above present levels. The Caribbean is projected to experience a greater sea level rise than most areas of the world due to its location closer to the equator and related gravitational and geophysical factors. Together with a projected decrease in rainfall, rising sea levels will lead to saline (salt) intrusion into coastal and groundwater aquifers and thus reduce fresh water availability.

Strand 2: Climate change

Unit 12: Climate change: Impacts and Responses

Topic 2: Mitigation and Adaptation

Activity 5: Fund-Ups

Purpose: Understanding climate change mitigation and adaptation and exploring, categorising and prioritising possible mitigation and adaptation actions.

Time needed: 45 minutes

Resources Needed:

- *Climate Change Actions Handout*, one per group of three

Procedure

Step 1: Ask students to work in groups of three. Give each group the *Climate Change Actions Handout*. As a class, read through these climate change actions. (5 minutes)

Step 2: Ask students in their groups to imagine they have been given ten million XCD to support action on climate change in St. Vincent and the Grenadines. Have students, in their groups, decide which actions they would like to fund and by how much. They cannot award more than their allotted total of ten million XCD but can divide this money in any way they want to between the actions noting the level of award they are giving to each action. (10 minutes)

Step 3: Ask each group to share and explain their decisions to the rest of the class. (10 minutes)

Step 4: As a class, discuss the different types of actions that are included. Explain the difference between mitigation and adaptation. Information on this is provided in *Box 6*. Which actions mitigate climate change? Which support adaptation to climate change? Which do both? Which are short-term actions and which are long-term? Why do they think some actions are more important than others? Are there any economic or socio-cultural reasons why some actions are less or more likely to be effective in SVG? Which operate at a local level? Which are national and which international? (20 minutes)

Box 6: Climate Change Mitigation and Adaptation

MITIGATION: Reducing or eliminating permanently long term risks and hazards of climate change, mainly by reducing greenhouse gases in the atmosphere

ADAPTATION: Any adjustment (change in conditions) in human behaviours, human and natural systems to prevent, moderate, cope with and take advantage of the effects of climate change

MITIGATION and ADAPTATION are, thus, complementary aspects of a coherent climate change strategy. Both call for lifestyle change. Both have to be factored into sustainable development plans.

Source: Mitigation and Adaptation definitions are taken from:

http://cdema.org/ccdm/index.php?option=com_phocadownload&view=category&id=2:national-programming&Itemid=67

Potential/Facilitation Tips

This session aims to explore some of the actions taken to mitigate against and adapt to climate change. Disagreement between students about the most effective actions is expected and should be encouraged. Be ready to play devil's advocate with what different groups and individuals say!

Curriculum Links

This activity supports Form 2 Health and Family Life Education, Strand 4 *Managing the Environment*, in particular, the theme of 'Health Promotion' which includes the learning objective 'Demonstrate proper environmental hygienic practices' and 'Design a plan to lessen the effects created by the hazards in the environment.'

Source: Adapted from Oberman. (2016). *Creating Futures*. Dublin: Trocaire/Centre for Human Rights and Citizenship Education, Dublin City University

Handout: Climate Change Actions

<p>Seeds for Life</p> <p>Providing crops that can grow in drier climates to farmers in SVG to help when there is drought</p>	<p>Be Safe Barriers</p> <p>Building barriers in SVG which protect people and their homes from flooding caused by sea-level rise</p>
<p>Greener Energy</p> <p>Building wind turbines and solar panels to get energy from these renewable sources instead of from fossil fuels</p>	<p>Rebuild, Restart</p> <p>Rebuilding roads, bridges and buildings damaged by floods and storms</p>
<p>Relief Now</p> <p>Providing instant relief to those people whose homes or crops hurricanes destroyed</p>	<p>Plant for All</p> <p>Planting trees to protect the soil, help people grow more food and soak up carbon in the atmosphere (carbon sink)</p>
<p>Educate for Change</p> <p>Supporting teachers and schools in SVG to make sure children learn about climate change and prevention of disasters.</p>	<p>Invent and Create</p> <p>Inventing machines that can be used in SVG and that are better for the environment, from tractors to long-life, energy-efficient light bulbs</p>
<p>Moving away from Methane</p> <p>Producing good vegetarian alternatives to meat products and encouraging people in SVG to eat less meat so that less methane is emitted from cattle which causes climate change</p>	<p>Turn it off for Earth</p> <p>Creating awareness in SVG about turning off lights, computers and other electrical devices when not in use.</p>
<p>Cycle Forward</p> <p>Providing bikes for people across SVG to use instead of cars to help prevent climate change.</p>	<p>Unite is Right: Together we Fight</p> <p>Helping people from SVG join with others around the world raise global awareness of the impacts of climate change and the need for climate action.</p>

Strand 2: Climate change

Unit 12: Climate change: Impacts and Responses

Topic 3: Mitigation/Adaptation Stories

Activity 6: Stories of Change

Purpose: Identifying the characteristics of effective climate change adaptation and mitigation.

Time needed: 75 minutes

Resources needed:

- Set of Climate Change Action Stories, one set per group of five.
- Five slips of paper per student
- Additional sheets of paper
- Flip chart and marker

Procedure

Step 1: Have students form groups of five. Give each student one of the *Climate Change Action Stories* so that in each group of five, each student has a different story. Explain that these stories describe local and global examples of adaptation and mitigation. Working quietly on their own, have them reflect on their story. Is their story an example of mitigation or adaptation or both? Have students write a short paragraph responding to the story on one of the slips of paper, beginning 'Effective climate change action is about...' Have students swap the stories around and repeat the step so that each student reads and responds to the five stories, writing five different paragraphs on five slips of paper. (30 minutes)

Step 2: Staying in their groups, request one member of each group to collect in the 25 responses, shuffle them, and then deal them out again as in a game of cards. Ask everyone to look at their 'hand,' discarding any responses they wrote and any about which they have reservations into a central pool. They should continue to toss into and pick up from the central pool until they are satisfied with their 'hand.' Say that the aim is for each group member to end up with a final 'hand' of up to three reactions that, to repeat, (a) they did not write themselves and (b) with which they roundly agree. (10 minutes)

Step 3: Invite groups to break into pairs or groups of three, read their chosen paragraphs to each other, and explain why they chose them. Ask pairs to negotiate and write down a composite one-paragraph statement beginning 'Effective climate change action is about...' Alternatively, if the pair cannot agree, they write a paragraph explaining their disagreement(s). (10 minutes)

Step 4: Invite groups of five persons to re-form, share, explain and discuss their composite statements. (15 minutes)

Step 5: Lead a short whole-group discussion asking each group, one by one, to identify up to three key criteria and elements of effective responses to climate change, including adapting to and mitigating against climate change. Write all contributions up on the flip chart or chalkboard. (10 minutes)

Extension

In terms of climate change mitigation, Dr. Ramsammy (Story 5) said, ‘there are things that every citizen in the world can do.’ Ask students to consider what this message means to them and write a short essay articulating their roles and actions in climate change mitigation. These can be posted on the classroom wall or otherwise shared.

Variation

Using the stories as stimuli, ask students to brainstorm problems associated with climate change. Have students working in groups identify one problem related to climate change and design a solution to that problem. They could begin by designing a solution on paper and then creating a model of the solution using waste materials.

Potential/Facilitation Tips:

This activity offers a format for a thoroughgoing yet time-economic sharing of reflections on climate change adaptation and mitigation examples in SVG and elsewhere. Ask participants to critically reflect on the stories and the perspectives of fellow students and try to reach a jointly agreed position on what makes for effective climate change adaptation and mitigation. The facilitator must set a brisk business-like pace for the activity. A detailed debriefing, in this case, is not essential; instead, let the learning that emerges ‘sink in.’

Curriculum Links:

This activity supports Form 2 Health and Family Life Education, Strand 4 ‘Managing the Environment’; in particular, the theme of ‘Health Promotion’ under which the achievement indicators include: ‘demonstrate proper environmental hygienic practices’ and ‘design a plan to lessen the effects created by the hazards in the environment.’ It also supports Form 2 Health and Family Life Education, Strand 4 ‘Managing the Environment’; in particular, the theme of ‘The Social Environment - Violence Prevention/Peace Promotion’ under which the achievement indicators include: ‘interact assertively with others’ and ‘listen and behave in such a manner as to allow others to express their values, thoughts and feelings effectively.’

Handout: Climate Change Action Stories

Story 1: Climate-Smart Agriculture with the Richmond Vale Academy

The agricultural sector in SVG is highly vulnerable to the changing climate, especially extended periods of drought, unevenly distributed rainfall patterns and increasing natural disasters. The changing climatic conditions affect the productivity and quality of crops. Reliance on one crop and the small-scale of farms in SVG leaves the sector economically vulnerable. Small farmers typically have little or no insurance and are ill equipped to deal with the impacts of climate change. Climate Smart Agriculture seeks to transition toward more climate-resilient production systems and more sustainable livelihoods in the context of climate change. The Richmond Vale Academy is a non-profit educational institution that seeks to train local and international youth and farmers in climate change, food security and poverty reduction through on-farm education. It is located on 30 acres of farmland on the leeward coast of St. Vincent.

Sustainable agricultural techniques employed at RVA include the following:

-Organic production and diversification: A variety of herbs and flowers (e.g. rosemary, thyme, chives, aloe, marigolds) are planted along the borders of the vegetable beds to deter pests instead of chemical being used. Animals graze in specific and strategic areas to assist with weed removal, also allowing for the spread of manure as organic fertilizer to revitalize and maintain the pH balance of the soil.

-Integrated farming: A system of continuous intercropping is used, mixing up different plant families within each bed. This helps protect species from potential pest problems and improves nitrogen levels in the soil.

-Renewable energy: RVA has introduced a solar panel system to become energy self-sufficient so as to remain operational if electricity fails due to climate change events and to reduce their fossil fuel footprint.

-Erosion control: New shallow trenches dug along the land's contour line horizontally have been constructed in the areas prone to erosion damage to slow water run-off supporting trees and other plants.

-Water harvesting, recycling and management: RVA has a rainwater harvesting system that collects rainwater from the roofs of the Academy and stores it in a 150,000-liter capacity pool.

-Agroforestry: Trees have been incorporated into the farming system to help capture carbon and other nutrients, such as nitrogen, and to improve soil health.

-Mulching and composting: Dry leaves and other organic matter are left to decompose on agricultural beds, and help to increase soil fertility and composition. This helps ensure that the crops cultivated can grow without the use of chemicals and creates a buffer against harsh climatic conditions.

Story 2: Desalination Plant in Bequia

Bequia is the second biggest island of the Grenadines, and has about 4,500 inhabitants. Because it has no surface water and no known underground water source, the inhabitants face a big challenge when it comes to potable water for drinking and cooking.

Each household traditionally has its own water collection system, but local people need to be very conscious about sharing their treasured water. Because of notable changes in the climate, seasons are not as reliable as they once were and it becomes harder to predict when the rain season will come. Droughts have become longer and more intense over the last few years.

The World Bank, Global Environment Fund (GEF), and the Caribbean Community Climate Change Centre (CCCCC) implemented a special program for adaptation to Climate Change in Bequia in 2012. The project contains several elements such as, for example, the solar power installation on the rooftop of the airport.

One of the main aspects of the project is a desalination plant in Bequia and a water distribution system on the same small island. This development seeks to find a sustainable solution to the problem that Bequia faces to provide its inhabitants with drinkable water. The current plant provides the population of Paget Farm's community – about 1,000 inhabitants – with clean drinking water as of 2012. All energy required for the operation of the desalination plant, is provided for by the solar panels on the roof of the airport, while surplus electrical energy is transmitted to the island's grid to allow for expansion.

With the aim to better understand the problems occurring as a result of the changing climate, and looking into sustainable solutions, research has been made by Climate Activists into desalination systems. The plant in Bequia is a good example of how to creatively adapt to the lack of resources and the field trips to the plant have brought a lot of new learning to those working on and interested in climate change action.

Source: Adapted from: <https://www.talkgreen.org/campaigns/research-and-studies/646-desalination-plant-in-bequia>

Story 3: Geothermal Energy in the Soufriere Hills

Like most of the countries of the Caribbean, St. Vincent and the Grenadines (SVG) is heavily dependent on imported petroleum products for electricity generation, transportation, cooking, and other energy requirements. It has an energy mix of more than 96% petroleum base and about 3% hydro power with emerging contributions from solar PV and geothermal. However, the country has potential local energy sources including geothermal, solar thermal, wind and biomass. Mainland St. Vincent is the only island from the tiny island chain that constitutes St. Vincent and the Grenadines, which does not depend entirely on diesel generation for their electricity supply.

In response to the rising cost of fuel on the international market and the need to diversify the country's energy mix with a higher proportion of renewable energy, the government established an Energy Conservation Fund in 2008. This fund was capitalised by an input of EC \$1 million per annum over a 3-year period. Under the Energy Conservation Fund, an Energy Conservation Programme was developed to promote indigenous sources of energy in the country. Following the expiration of the programme, the Energy Unit was established to assist with the formulation and implementation of Government's policies related to energy, and to coordinate specific activities related to Government's renewable energy and energy efficiency initiatives.

In 2019 the first geothermal site was built in the Soufriere Hills, by the St Vincent Geothermal Company Limited, owned by Reykjavik Geothermal and the Government of St Vincent. The programme is supported by other countries, including the US, UK and Japan. The plant has a 10 MW output and can supply the baseload power for the nation. This will mean 73% of the country's energy is from renewable sources.

Source: Adapted from <http://energyunit.gov.vc/energyunit/index.php/2013-02-20-08-59-23>

Story 4: Solar Market Gardens in Benin

Benin is a country in West Africa. In the northern region of Benin, the dry season between rains can last six to nine months at a time. Because most of Benin's smallholder farmers rely on rain-fed agriculture for both their food supply and their income, the dry season can be a time not only of food insecurity but of poverty, illness and malnutrition.

In 2007, two US based organisations, who had been helping to electrify 44 villages in the area with solar power helped the villages install solar arrays to power drip irrigation pumps, which farmers now use to grow high-valued crops in 'solar market gardens.'

The solar arrays, which are paid for by the US-based organisations and installed and maintained by villagers, use the sun's energy to power water pumps that tap into deep wells. The pumps deliver water to plants through a system of rubber hoses with small perforations, so that water drips onto the roots of individual plants throughout the day, reducing water waste and improving plant growth. In the dry season these crops provide a steady food source, better nutrition, and higher household incomes as families sell extra produce at nearby markets. A local women's farming cooperative works with the two US organisations to measure the impact of this system and see how it helps people's food, income, health and well-being during the dry season.

Source: Adapted from:

https://fsi.stanford.edu/research/solar_market_gardens_as_a_tool_for_rural_development

Story 5: Mangroves to Save Guyana's Shrinking Coastline

Agriculture has always been particularly important for Guyana. It accounts for more than 20 percent of the country's Gross Domestic Product (GDP) and nearly half of its exports are agricultural. Guyana is seen as an important source of food for the entire Caribbean area. But the chief executive officer of the National Agricultural Research and Extension Institute (NAREI), Dr. Oudho Homenauth, warns that climate change is robbing Guyana of some of its prime agricultural land. 'We are seeing increasing rainfall, higher tides and so forth ... The seawater, as you know, is saline and once saline water gets on the land it is very difficult for that land to recover for crop production because there is nothing we can do in terms of adding any kind of amendment to correct soil salinity.'

Mangroves are very important for Guyana, especially for coastal areas and now the country is working hard to protect and restore them. Approximately 90 percent of Guyana's population lives on a narrow coastline strip a half to one meter below sea level. That coastal belt is protected by seawall barriers that have existed since the Dutch occupation of the country. In recent times, however, severe storms have toppled these defenses, resulting in significant flooding, a danger scientists predict may become more frequent. Maintaining the seawalls is an enormous cost for Guyana, which has been spending an average of three billion dollars a year to maintain and strengthen the defenses.

Agriculture Minister Dr. Leslie Ramsammy said, '... in order to ensure that the seawall and sea dams continue to serve us well and to be less vulnerable to the onslaught of the ocean, we have been protecting and promoting the growth of mangroves and other structures such as geotextile tubes to reduce the impact of the waves coming in... . We've been doing bamboo growth along the seawalls to reduce the impact of the waves coming in. So a number of different structures are being tried but mangroves represent a major response of the Guyana government in supporting the seawall and therefore reducing the impact of water hitting against the wall, against the dams etc.'

As well as accelerating the growth of mangroves, Guyana has been conducting research to determine the best technology to use to achieve success in growing new mangroves.

Dr Ramsammy noted that no country is too small to do something about climate change. He said, 'There are things that every citizen in the world can do. I've heard people say, "I'm poor and I'm not a scientist and I can't do anything." In fact we can do much as small countries.'

Source: Adapted from:

<http://www.ipsnews.net/2014/05/mangroves-savior-guyanas-shrinking-coastline/Mapping>

Strand 3: Climatological Hazards

Unit 3: Flooding

Topic 1: Human Impact Stories

Activity 7: The Christmas Eve 2013 Flash Flood

Purpose: Understanding the impacts on people of flash floods; considering actions to mitigate future flash flood risk

Time needed: 80 minutes

Resources needed

- Christmas Eve Flood video documentary (2 minutes):
<http://casestudies.ourplaceonearth.org/saint-vincent/>
- A Christmas Eve Flood handout per person
- A pen, pencil and notepad per student
- Internet slideshow, 'As worsening storms slam the Caribbean St. Vincent Fights Back' (Thomson Reuters Foundation, 30 May 2014):
<http://news.trust.org/slideshow/?id=d5bcf37d-b500-4cb6-ace3-09dd0d63df18>

Procedure

Step 1: Drawing on information from *Box 7*, introduce the flash flood disaster that hit St Vincent and the Grenadines on Christmas Eve, 2013, when 12 inches of rain fell in three hours, causing rivers to burst their banks, battering homes, roads and other infrastructure, destroying livelihoods, and claiming twelve lives. Ask students what they remember about the incident or what parents and community members have told them. Then show the short video documentary. (15 minutes)

Box 7

On 24 December 2013, as families prepared for the Christmas holiday and as families and friends gathered to celebrate with food and drink and festivities, an unexpected storm broke out across the mainland. What is now called the Christmas Eve Flood devastated the mainland with massive landslides and flooding, causing large-scale destruction to roads, buildings and bridges. Within a matter of hours 12 people died and \$108.3 million worth of damage, a figure equivalent to 15 per cent of the country's annual GDP, was inflicted. All hydroelectric facilities were forced offline, leaving some households without power until mid-2014. The Government declared a level two disaster (this is declared if the damage is severe, when local resources cannot cope, and external recovery assistance is needed).

Source: *Community Capacity: Enabling Local Leaders: An Exploration of Community-Based Climate Action, St, Vincent and the Grenadines*, OPOE, 6.

https://static1.squarespace.com/static/532729ebe4b03d5774a82e00/t/57053eaca3360cf82b68dae9/1459961606131/SVG_CaseStudy_Print.pdf Also: <https://reliefweb.int/disaster/fl-2013-000159-vct>

Step 2: Distribute the handout to students and ask them to read the story quietly, taking notes and considering the following questions (write them on the board) as they read:

- What are the lessons you have learnt from the video and the story?
- What were the physical impacts of the disaster for flood victims?
- What were the psychological impacts of the disaster for flood victims?
- What could and should be done to prevent an incident like this happening again?
- What are the things you and your family and local community could do to lessen the threat of flooding?

(15 minutes)

Step 3: Ask students to form pairs and share their views on the first question. After 4 minutes, ask pairs to report back to the whole group briefly. Then ask the class to form new pairs to share views on the second and third questions and, again after 4 minutes, report back to the whole class. Repeat the process with new pairs for the fourth and fifth questions. Throughout give four minutes for class sharing and throughout list key points made on the board. (25 minutes).

Step 4: One by one, show the slides of flood-affected communities and their surroundings. Ask students to use their observational powers to point out the particular features of each photo that either confirms response to the five questions or extends their thinking or makes them rethink. (25 minutes)

Extension

Have students form groups of six and ask them to prepare a short Christmas Eve 2013 drama capturing the thoughts and emotions of householders as the floods break-in on their Christmas Eve celebrations. Alternatively, ask them to perform a drama of looking out on Christmas Day morning. Ask each group to act out their drama before the class.

Potential/Facilitation Tips

Step 1 would facilitate discussion if the class were asked to seek information from family and community about the Christmas Eve floods in advance of the lesson. Add your memories to the discussion, too. As you show the photos in *Step 4*, also encourage an emotional and empathetic response to each image.

Curriculum Links

This activity complements the 'Man-Made Systems (Regional)' section of the Form 2 Geography curriculum, where floods, among other hazards, are to be covered. The learning objectives include: explaining the development of floods and other hazards, identifying ways people can be disaster-prepared and suggesting coping strategies in post-disaster contexts. It equally complements the Form 2 Health and Family Life Education curriculum that, amongst other things, calls on students to research the economic costs of natural disasters, examine the effects of natural disasters on

families, and discuss the emotional impacts of natural disasters. A link can be made, too, with Form 2 Social Sciences that, under the 'Historical Background' theme, ask students to identify and understand major historical events, including disasters that have affected the lives of Vincentians.

Source: Adapted from: Selby & Kagawa. 2014. Disaster Risk Reduction Education Toolkit, 66-7.

Handout: The Christmas Eve Flood in Vermont: Two People's Stories

Corinthian Haddaway, a 46-year-old tailor from lower Vermont, lost all his belongings to the Christmas Eve flood. His house sits perched precariously on the Vermont River bank, and he is hoping that efforts to stabilise the nearby slopes and protect the river embankment, part of an upcoming project, will prevent such huge losses in the future. 'I just lived through the worst disaster I have ever seen. I do not sleep here any more. I have nightmares and I am afraid of flash flooding,' he said.

These days, 'I know with Mother Nature and the hurricane season on the way, you can not stop rain or inclement weather, but if we can help reduce the impact of weather like what we saw on Christmas Eve, this will help all of us who call this place home,' he said.

Just a few miles north, at upper Vermont, Renard Moses walks across the bridge that he built after the Christmas Eve rains washed away the one constructed by the government. Moses employs 10 young men at his scrap metal and construction equipment rental company. Like Haddaway, he describes last December's rains and flooding as the worst he'd ever seen. The 43-year-old, who has lived in upper Vermont since 1980, remembers waving to his neighbour across the river when the rain started. Hours later that neighbour's body would be found a few miles away, washed away by raging flood waters.

Moses said his losses to the storm were estimated at \$250,000 but he was simply thankful to be alive. He built the new bridge to ensure school children would no longer have to get across the river by walking along utility poles laid down as a makeshift bridge.

But he worries that with the official June 1st start of the annual hurricane season nearly here the river could once again burst its banks and cause untold damage. Improving the embankments that protect homes and businesses from the river is crucial to avoiding more losses, he says. 'I believe a project like this could go a long way in putting the community at ease. After what I saw on Christmas Eve 2013, I will never again underestimate the power of nature,' he said. "I was forced to wade through neck-high water to save my disabled son and wife. The river became a monster and was everywhere. When the bridge collapsed, we were stranded across the river for three days before someone put utility poles for us to cross.'

He said he understands the new river embankment protection measures may not be in place in time for this year's hurricane season, but nonetheless, 'I hope it can be done quickly,' he said.

Source: Adapted from Thomson Reuters Foundation, *Flood-hit Caribbean island moves to battle the deluge and cut losses*. (30 May 2014). <http://news.trust.org/item/20140523224327-2eih6/>

Strand 3: Climatological Hazards

Unit 3: Flooding

Topic 2 Safety Measures

Activity 8: Flood-Safe Timelines and Sketches

Purpose: Understanding what safety measures to take before a flood when there is a warning of imminent flooding when flooding happens and in the aftermath of flooding.

Time needed: 85 minutes

Resources needed

- Some glue sticks
- For each group of four students: a long strip of paper created by cutting a sheet of chart paper down the middle from the short side to the short side and sticking the two halves together
- A cut-up and jumbled set of *Flood Safety Cards* for each group of four students
- Masking tape

Procedure

Step 1: Begin by saying that floods are amongst the most frequent, deadly and costly of natural disasters and that it is vital for families and communities to ensure their safety by being flood-wise. Then, drawing on NEMO information in *Box 8* as necessary, check that students are familiar with the nature of a flood and the different types of flood that affect St Vincent and the Grenadines and the wider Caribbean region. (10 minutes)

Box 8

A *flood* is an abnormal, steady rise in water levels of streams or rivers that may result in overflowing, submerging surrounding land.

A *flash flood* is the result of heavy rainfall or a cloudburst over a very small area. They can occur within minutes or hours of excessive rain. They carry highly destructive flood waves and are most common in mountainous areas or in steep places that have streams flowing through narrow canyons or gullies.

A *tidal flood* happens when large bodies of water such as the sea or lakes overflow into bordering land. They mainly happen when there are high tides, when a hurricane brings heavy rain, and when big waves come because of wind surges or tsunamis.

Source: <http://nemo.gov.vc/nemo/index.php/hazards/flooding/266-what-is-a-flood>

Step 2: Have students form groups of four and hand each group a set of *Flood Safety Cards*. Explain that their task is to draw a timeline along their strip of paper and divide it into four sections. The sections are to be titled: Well In Advance of a Flood; Right Before a Flood; When Flooding Happens; After Flooding. Go on to explain that they are to place and to stick down each card along the timeline. Elaborate the task by pointing out that: (1) the ordering of cards *within* a section might be necessary; (2) a card may be relevant to two sections in which case they should stick it along the borderline between the two sections in question; (3) a card may be relevant to all three sections in which case they can draw arrows from where they place it, so the arrows go along the whole timeline. Say that they can write notes or captions on their timeline as they see fit. When the groups have finished their work, they stick their timeline on the wall or lay it on a tabletop. (20 minutes)

Step 3: Ask students to visit and inspect each other's work, group members taking it in turns to stand by their timeline and receive visitors, answering any questions they have. Have a whole-class discussion focusing on flooding protection advice they had not previously come across or thought about when the visit is complete. (25 minutes)

Step 4: Have groups re-form and give them the task of choosing one section of their timeline and representing the guidance it contains as a small drama. For instance, a group might choose the Imminent Flood Danger section and role-play what a family should do when they learn that flooding will likely happen quite soon. Have each group perform their drama. (30 minutes)

Extensions

Explain that the guidance in the cards is mainly taken from the SVG National Emergency Management Organization website. Have students explore the website as homework: <http://nemo.gov.vc/nemo/index.php/hazards/flooding>

Have students note all the cards they have placed under the 'Well in Advance of a Flood' section of their timeline. Ask them to take their notes home and discuss, with parents and family, whether the actions suggested in the cards are in place. Discuss what they found when they return to school.

Potential/Facilitation Tips

It is important to ensure in *Step 1* that the whole class understands key terms and concepts associated with flooding. During *Step 2*, move between groups and encourage them to think hard about card placement and whether a card has relevance to more than one section. Join in the touring of group work in *Step 3* and base the whole class discussion around students' queries and thoughts as prompted by each other's work. A card that might engender much debate is the one referring to a disaster survival kit. The class might want to brainstorm or propose essential items to include. Encourage comment on group dramas during *Step 4* and congratulate groups.

Curriculum Links

This activity complements the 'Man-Made Systems (Regional)' section of the Form 2 Geography curriculum, where floods, among other hazards, are to be covered. The learning objectives include: explaining the development of floods and other hazards, identifying ways people can be disaster-prepared and suggesting coping strategies in post-disaster contexts. It equally complements the Form 2 Health and Family Life Education curriculum that, amongst other things, calls on students to research the economic costs of natural disasters, examine the effects of natural disasters on families, and discuss the emotional impacts of natural disasters. The small drama to be developed and enacted in *Step 4* accords with the 'participating and collaborating' strand of the Creative Arts (Drama) curriculum and its suggested teaching/learning activities involving improvisational methods.

Flood Safety Cards

Find out if your home is in a flood-prone area	Regularly check on weather conditions
Put important documents in water-proof storage bags	Store materials like sandbags, plastic sheets and wood to protect against floods
Be aware of where the nearest evacuation shelter is	Make sure everyone is familiar with flood-safe escape routes from home that are suitable for everyone, including the elderly, disabled, very young and pets
Store chemicals, important documents and electrical devices in places above expected water levels	Keep the home and community clear of garbage and debris that might block drains
In case you have to evacuate, have a disaster survival kit ready to grab.	Make sure everyone in the family knows how to turn off utilities
Listen to the radio or television for regular flood information updates	If you live in an area with flash flood potential, move immediately to higher ground
Do not wait for instructions to move but take the initiative if the flood threat feels real and immediate	If you need to evacuate, secure your home and move essential/important things upstairs
If you need to evacuate, turn off mains switches and disconnect electrical appliances but don't touch electrical things if wet or if you are standing in water	Don't go sightseeing in areas that are flooded or have been flooded

<p>If caught suddenly by rising water, go upstairs or out onto the roof, taking with you warm clothes and a flashlight (go to a neighbor with a sturdy house if your own home is single-story)</p>	<p>If you leave home, do not walk through moving water – even six inches of water can make you fall or be swept away</p>
<p>When returning home, be cautious, move slowly and do not touch electrical appliances</p>	<p>When returning home, open windows and doors to let air circulate, remove foul smells, protect against gas escapes and begin drying out the home</p>
<p>Throw out any perishable food as it may be contaminated</p>	<p>Begin cleaning up and shovel out any mud while it is still moist</p>
<p>Hose down furniture, rugs and carpets and dry them thoroughly</p>	<p>Boil and store drinking water tightly seal garbage, cover and protect food</p>
<p>Wear boots and shoes inside and outside</p>	<p>Do not touch any loose or dangling wires</p>
<p>Bury dead animals as soon as possible</p>	<p>Be cautious crossing any bridges near or over rivers</p>
<p>Do not drink floodwater or use it to wash dishes, brush teeth or prepare food</p>	<p>Listen to advice from official sources to find out when water is safe again for drinking</p>

Strand 3: Climatological Hazards

Unit 3: Flooding

Topic 3 Collecting Local Experience; Pursuing Advocacy and Action

Activity 9: Flooding: Local Enquiry and Advocacy

Purpose: Exploring the causes and impacts of floods and finding out, through community enquiry and advocacy, what can be done to mitigate local flood threat

Time needed: 145 minutes (45 for *Stage 1*; 100 for *Stage 2*, reduced if more homework time is made available)

Resources needed

- A cut-up set of *Flooding: Causes* and *Flooding Effects* statements for each group of 5 or 6 students
- A sheet of chart paper and marker for each group
- Further chart paper and colour markers for poster presentations

Procedure

Stage 1: Looking at Causes and Effects

Step 1: Divide the class into groups of five or six, ensuring, as much as possible, that the students making up a group come from the same locality. Explain that the class will have a general look at the causes and effects of flooding before applying what they have learnt to their locality through out-of-school conversations with local people. Say that they will also be given a chance to present their findings to adults in the community. (5 minutes)

Step 2: Hand each group a set of *Flooding: Causes* and *Flooding Effects* statements. Ask groups to read the cards and consider how they might arrange the statements on their sheet of chart paper. They might, for instance, want to link certain statements with two-way arrows if they see a connection between them; the group might want to cluster the cards into categories and give each cluster a heading; they might want to do an entirely different kind of presentation (e.g., develop a narrative around the cards; discuss the cards, each playing a different role). Importantly, they should write in a commentary or questions about particular cards or particular clusters of cards especially focusing on ideas for mitigating flooding causes and mitigating and adapting to effects. Indicate that when their group work is complete, they will be asked to present and explain what they have produced. (20 minutes)

Step 3: Have groups present, encouraging class responses and questions after each input. As the discussion moves along, ensure that ideas for mitigating causes and effects are thoroughly aired. (20 minutes)

Step 4: End this stage of the activity by having groups prepare questions they will put in out-of-school interviews with adults in the community about the causes and effects of flooding and ways of mitigating and adapting to flooding. Do the causes and

effects apply in their locality? Are there other causes and effects? Are the mitigation and adaptation suggestions they have come up with in class feasible in their locality? Do those being interviewed have their ideas for preventing or limiting flooding? Give groups one week for interviewing local people and making ready the report to be presented in class. (15 minutes)

Stage 2: Presenting Findings

Step 1: When the next class on flooding is held, have each group present their report on their community conversations, encouraging discussion of ideas presented after each presentation. Then have the class share ideas on how to bring their findings together for an effective, polished whole class presentation to community members. Give students additional time in class and out of class to develop what they will say and prepare their presentation, including posters, photos, and video material. (60 minutes)

Step 2: *Either* invite some community members, drawing in part from those interviewed, to a presentation at the school. *Or* arrange for the class to present their work at a community gathering. In each case, have community members comment on what the students present (40 minutes)

Variation

Invite a representative from NEMO to listen and respond to the class presentation and the views of local community members in attendance.

Potential/Facilitation Tips

This activity takes students through a series of stages towards deepening engagement with flooding issues. In the first instance, they become familiar with general explanations of the causes and effects of flooding from expert (NEMO/CDEMA) sources. They are then asked to test those explanations against what local people know, think and have experienced. Do the general explanations stand up in the opinion of the community? Does community experience affirm them? Have additional or alternative views of the causes and effects of flooding and ways of preventing or adapting to flooding come to light through the interviewing? Having gathered local responses, they prepare a presentation to which those who have provided information and opinion are invited to attend and respond. Therefore, the activity marries an initial engagement with flooding issues with interviewing in the locality to garner local opinion and perspectives, followed by an advocacy element with and in the locality. In preparing to facilitate the activity, browse the December 2016 SVG government report, *Rapid Damage and Loss Assessment* on flooding:

https://www.gfdrr.org/sites/default/files/publication/SVG_Rapid_DaLA_Dec2016_FIN_AL.pdf

Curriculum Links

This activity complements the 'Man-Made Systems (Regional)' section of the Form 2 Geography curriculum, where floods, among other hazards, are to be covered. The learning objectives include: explaining the development of floods and other hazards,

identifying ways people can be disaster-prepared and suggesting coping strategies in post-disaster contexts. It equally complements the Form 2 Health and Family Life Education curriculum that, amongst other things, calls on students to research the economic costs of natural disasters, examine the effects of natural disasters on families, and discuss the emotional impacts of natural disasters. The activity also meets the Form 2 English curriculum, learning outcome 2, 'communicate to send and receive information,' achievement indicator 10, 'conduct short interviews and present findings'.

Causes of Flooding

Deforestation

Flooding is much more likely to happen when areas covered by trees are chopped down. Trees and plants absorb water. If a site is cleared of its natural vegetation, especially its trees, there is little left to absorb water, so rain will quickly flow away into rivers and streams. It happens extremely quickly in steep, hill and valley areas where trees have been cut down.

Climate change

The effect of climate change on St Vincent is that extended periods without rain are being experienced, followed by shorter periods of exceptionally heavy rain. When these heavy rains come, they fall on the hardened ground and the water runs off the land, increasing the likelihood of floods.

Poor farming practice

On St Vincent, many farmers are still practicing mono cropping (i.e. growing just a single crop), which chemical fertilizers must support to maintain crop yield. The chemicals break down the soil structure, making it dry and sandy. Increasingly heavy rainy periods just wash away the soil, leading to flooding. There is also a lot of unofficial slashing and burning of forests to grow crops and this encourages water to run off from the slopes.

Poor drainage facilities

If drainage channels and structures are not regularly maintained and cleared of natural debris and human garbage, they will tend to block, causing flooding. If we do not extend, improve and redesign the drainage system to cope with the greater volume of water that comes with increasingly heavy periods of rainfall, there is likely to be flooding.

Reduction of water-holding surfaces

There is a tendency, especially in urban areas, to concrete or tarmac over the bare ground in the name of urban landscaping. This practice results in fewer and fewer places for rain to be absorbed.

Construction of buildings in inappropriate places

Population increases lead to a demand for more housing. When that demand is met by building new human settlements on flood plains, i.e., low-lying areas adjacent to a river or stream, there is every likelihood that residents will experience flooding. Other residential areas presenting a potential flood hazard include those in low-lying coastal towns and villages, those sitting on the edge of gullies with streams coming down from the hills and those situated in low-lying, closed valleys.

Sources:

<https://reliefweb.int/report/saint-vincent-and-grenadines/how-devastating-hurricane-led-st-vincent-s-first-sustainability>

<http://nemo.gov.vc/nemo/index.php/hazards/flooding/265-what-causes-flood>

Effects of Flooding

Health

Flooding can contaminate water supplies and food and spread disease very quickly. Floods also leave stagnant water pools that provide a perfect breeding ground for disease-carrying mosquitos.

Homelessness

Flooding can leave people without a home to live in and others without a safe home.

Food shortages

Floods destroy crops and livestock, leading to a shortage of food supplies.

Economic disruption

Flooding can take away people's work and livelihood, leaving them in poverty; businesses can't function normally for days, even weeks, and fold; the national economy suffers.

Destruction of roads

Floods can destroy roads and bridges at a massive economic cost, taking months to repair. Immediately following a flood, helicopters, aircraft, and boats have to reach communities cut off by road.

Curtailement of social life

Flood destroys roads and buildings, often meaning that ordinary social activities (family visits, sporting events, cultural events) cannot occur for some time.

Loss of tourism revenue

Tourists tend to cancel visiting countries and places that have suffered badly from flooding and other disasters, meaning hotels, restaurants, and other tourist facilities suffer, resulting in job loss.

Landslides

Floods can trigger landslides that threaten lives, buildings and communities.

Deaths

Floods can cause death from drowning, building collapse, or electrocution

Evacuation

Floods and their many devastating impacts can mean that families and communities must be evacuated for short and often lengthy periods.

Source: CDEMA: <http://nemo.gov.vc/nemo/index.php/hazards/flooding/263-evacuation-flooding>

Strand 4: Geological Hazards
Unit 4: Volcanoes
Topic 1: La Soufrière Volcano

Activity 10: The Disaster Risk that is La Soufrière Volcano

Purpose: Learning about La Soufrière volcano, its geology, eruption history, and the dangers that it poses to local communities

In preparation for facilitating this activity and responding to student queries review reports and documents about the April 2021 eruption and identify sources where students can gather more information on the eruption.

Time needed: 50 minutes

Resources needed

- Six video clips of Dr. Richard Robertson from the Seismic Research Centre of the University of West Indies and the STREVA (Strengthening Resilience in Volcanic Areas) Project explaining the features of the La Soufrière volcano, its pyroclastic flows of lava, rock, and gaseous materials and the dangers they present:

https://www.youtube.com/watch?v=XHNPH4KzvdI&list=PLiS3_A16hggHEXPGPBBikyMqhh_mW/xg9s

Procedure

Step 1: Begin by asking the class to share what they know about volcanoes in general and La Soufrière volcano in particular. What is a volcano? When did La Soufrière last erupt? What happened? What do people in the community say about the volcano? Note down ideas and information offered. Find out if anyone experience an eruption and ask them to share their experience. Compare the class experience with the information on 1979 in *Box 9*. (10 minutes)

Box 9

A volcano is a mountain that opens downwards to a reservoir of molten rock below the surface of the earth. When pressure from gases within the molten rock becomes too great, an eruption occurs. Eruptions can be quiet or explosive. There can be pyroclastic flows (of lava and/or rock), poisonous gases, and flying rock and ash sometimes travelling hundreds of miles downwind. Pyroclastic flows are a great fire hazards, destroying everything in their path. Fresh volcanic ash, made of pulverized rock, can be abrasive gritty, gassy and sulphuric. The gas released, while not immediately dangerous to a healthy adult, can harm the lungs of children, the infirm and the aged. Ash can affect peoples hundreds of miles away.

Source: <http://nemo.gov.vc/nemo/index.php/hazards/volcanoes/310-what-is-a-volcano-2>

Eruptions of La Soufrière volcano occurred in 1902 and 1979 and 2021. In 1979 a six-hour eruption warning allowed 20,000 people in the north of St Vincent to be evacuated to the south. A total of 15,000 were housed in shelters with a further 3,000 displaced persons put up in homes. Evacuation centres were started in school, churches and government building, all of which lacked adequate hygiene and sanitation facilities.

On 9 April 2021 La Soufrière erupted explosively, over 25,000 people evacuated mainly from the Red and Orange zones to the safer locations. Almost 5,000 people were housed in stated designated shelters while many others stayed in other types of accommodation with family, friends and even strangers. The last major eruption was on 22 April 2021 but persons were not allowed to return to the impacted areas until May 2021 when the scientist determined it was safe to start moving back.

Step 2: Explain to the students that they are going to watch six short video clips and that during the showing of each, they should note down questions and things explained that particularly strike them. Say that after each video, there will be a sharing of questions, thoughts and impressions. Show the first video, *Into the Crater*. Then invite a sharing of questions, ideas and impressions. (12 minutes, including 3:42 minutes for the video clips)

Step 3: Go on to show the second and third video clips, i.e., *The Old Mill* and *River Deposits*. After both have been shown, invite a further round of discussion and feedback. (13 minutes, including 2:50 and 3:09 minutes for the video clips)

Step 4: Continue by showing the fourth, fifth and sixth video clips, i.e., *The Rabacca Bridge*, *Orange Hill*, and *Fancy*. After the clips have been shown, again invite discussion on what has been viewed. End the session by asking students to interview one or two adults who experienced and have memories of the La Soufrière eruption of 1979. Ask them to bring to the next lesson a one-page written summary of stories they hear to share with others. (15 minutes, including 2:1, 1:41 and 1:48 minutes for the video clips).

Potential/Facilitation Tips

The sequence of video clips begins with a weighting towards the geological and physical with a progressive shift towards the protection of human communities. In the discussion that closes *Step 2* there is likely to be a focus on the enormity of the crater, the volcano dome and its present stability, and means of monitoring the volcano. In the *Step 3* discussion, attention is likely to turn to the destruction of a sugar-producing community in the 1902 eruption, a relatively small eruption. Ask students to gather information on the 2021 eruption to have a discussion on what happened in communities and the economy as a result of the recent eruption.

The third video, *River Deposits*, will also alert students to the thickness of some pyroclastic flows in the volcano, indicating massive past eruptions that far outweighed the force and size of the 1902 and 1979 eruptions. Take the discussion further based on the information gathered about the 2021 eruption to focus on the

pre-eruption evacuation of the communities the Red and Orange Zones, those more severely impacted by the volcano.

In preparation for facilitating this activity and responding to student queries, read *Case Study 6, Earthquakes*, in the *Resource Manual*.

Curriculum Links

This activity accords with the Form 2 'Man-Made Systems (Regional) section of the Geography curriculum that, among other hazards, covers volcanoes. The curriculum has the following learning objectives: distinguishing between natural and man-made disasters, explaining disaster preparedness, explaining the development of disasters, including volcanic eruptions, identifying ways in which people can be disaster prepared. This activity also complements the Form 2 Health and Family Life Education curriculum 'Disaster Preparedness' theme. In this theme, students should demonstrate the ability to 'analyze the societal impact of natural disasters' by being able to 'conduct research on the economic costs of natural disasters,' 'show understanding of how natural disasters impact the health care system' and 'examine the effects on natural disasters on families and relationships.'

Strand 4: Geological Hazards

Unit 4: Volcanoes

Topic 2: La Soufrière Volcano: Human Impact Stories

Activity 11: La Soufrière Stories

Purpose: Sharing and analyzing stories of the La Soufrière eruption of 1979 and identifying lessons for the future

Time needed: 55 minutes

Resources needed

- Stories collected by the students
- Three video clips of Vincentians recollecting the 1979 eruption: https://www.youtube.com/playlist?list=PLiS3_A16hqqFYpmagNAHcR3guKoO_qO4K
- Student notebooks
- News and video clips of the 2021 eruption, check NEMO as well as the internet for support

Procedure

Step 1: Explain that the class will share reminiscences and reflections on the 2021 eruption collected through interviews while also watching people living close to the volcano share their memories. Draw three columns on the board titled: *Responses and Experiences*, *Lessons Learnt* and *Protection and Resilience as well as videos from 2021*. Have students draw the columns in their notebooks. (5 minutes). Have student make comparisons where possible between 1979 and 2021.

Step 2: Have the class watch the Eruption and Response and Recovery video clips. Then, looking at each column, ask the students what entries to make given what they have seen in the videos. Write items on the board and ask students to note them down too. Importantly, then ask students to share from their experiences and or interviews and stories they have collected that substantiate or confirm what has been summarized in the three columns. (30 minutes, including 5:59 minutes and 7:04 minutes for the video clips).

Step 3: Then show the third video clip, *Living with the Volcano*, and repeat the Step 2 process. As a concluding task, ask students to read out or otherwise share those aspects of the stories they have collected that are not captured by what has been written in the three columns. Conclude with a general discussion about living with La Soufrière. As homework set, students write a one-page thought piece drawing on what they have viewed, heard and experienced and recorded in the columns. (25 minutes, including 6:34 for the video clip).

Potential/Facilitation Tips

This activity asks students to compare data from their interviews with a documentary film of people reflecting on the 2021 volcanic eruption. Encourage a lively sharing of ideas and collected stories. In *Step 3*, underline the reasons put forward for being confident that they are now much better prepared should the volcano erupt again than were people and authorities in 1979 and 2021.

Curriculum Links

This activity accords with the Form 2 'Man-Made Systems (Regional)' section of the Geography curriculum that, among other hazards, covers volcanoes. The curriculum has the following learning objectives: distinguishing between natural and man-made disasters, explaining disaster preparedness, explaining the development of disasters, including volcanic eruptions, identifying ways in which people can be disaster prepared. This activity complements the Form 2 Health and Family Life Education curriculum 'Disaster Preparedness' theme. This theme calls for students to demonstrate the ability to 'analyze the societal impact of natural disasters' by being able to 'conduct research on the economic costs of natural disasters,' 'show understanding of how natural disasters impact the health care system' and 'examine the effects on natural disasters on families and relationships.' The interview element in the activity meets the Form 2 English curriculum, learning outcome 2, 'communicate to send and receive information,' achievement indicator 10, 'conduct short interviews and present findings.'

Activity 12: Being Volcano-Ready

Purpose: Learning volcano safety measures while developing media literacy skills in critically reading and composing messages about volcano safety and preparedness and practicing volcano-ready advocacy

Time needed: 60 minutes

Resources needed

- Internet availability of the NEMO St Vincent and the Grenadines *Volcanic Hazard Map*:
<https://www.facebook.com/nemosvg/photos/volcanic-hazard-map-st-vincenthazard-zone-1-red-zone-very-high-hazardthis-includ/2083525418358070/>
- One cut-up set of *Volcano-Ready* cards
- Chart paper, colour markers/crayons and/or paints for a poster drawing
- Masking tape
- If obtainable, a selection of volcano awareness/preparedness posters for the *Variation* part-activity

Procedure

Step 1: Have students inspect the NEMO *Volcanic Hazard Map* and its Red, Orange, Yellow and Green Zones. Using *Box 10* below, explain the different zones. Emphasize that the zones are land zones but that their effects will also be felt in offshore areas for some distance. Have students identify (a) the zone in which they usually live, (b) zones in which they sometimes stay, (c) zones to which future life or work might take them. Point out that, with population mobility, they may presently live in the Green Zone, but they might find themselves living in the Red Zone in the future. Population mobility is a reason why all Vincentians should be volcano-ready. (10 minutes)

Box 10

Hazard Zone 1 (Red Zone) Very High Hazard

This includes all areas expected to suffer maximum damage if La Soufrière erupts. It is the zone where hazardous events such as pyroclastic flows and surges, mudflows and projectiles (i.e., rocks flying through the air) have their maximum effect. The zone is likely to experience more than 30cm of volcanic ash. During the eruption, the area is unsuitable for human habitation.

Hazard Zone 2 (Orange Zone) High Hazard

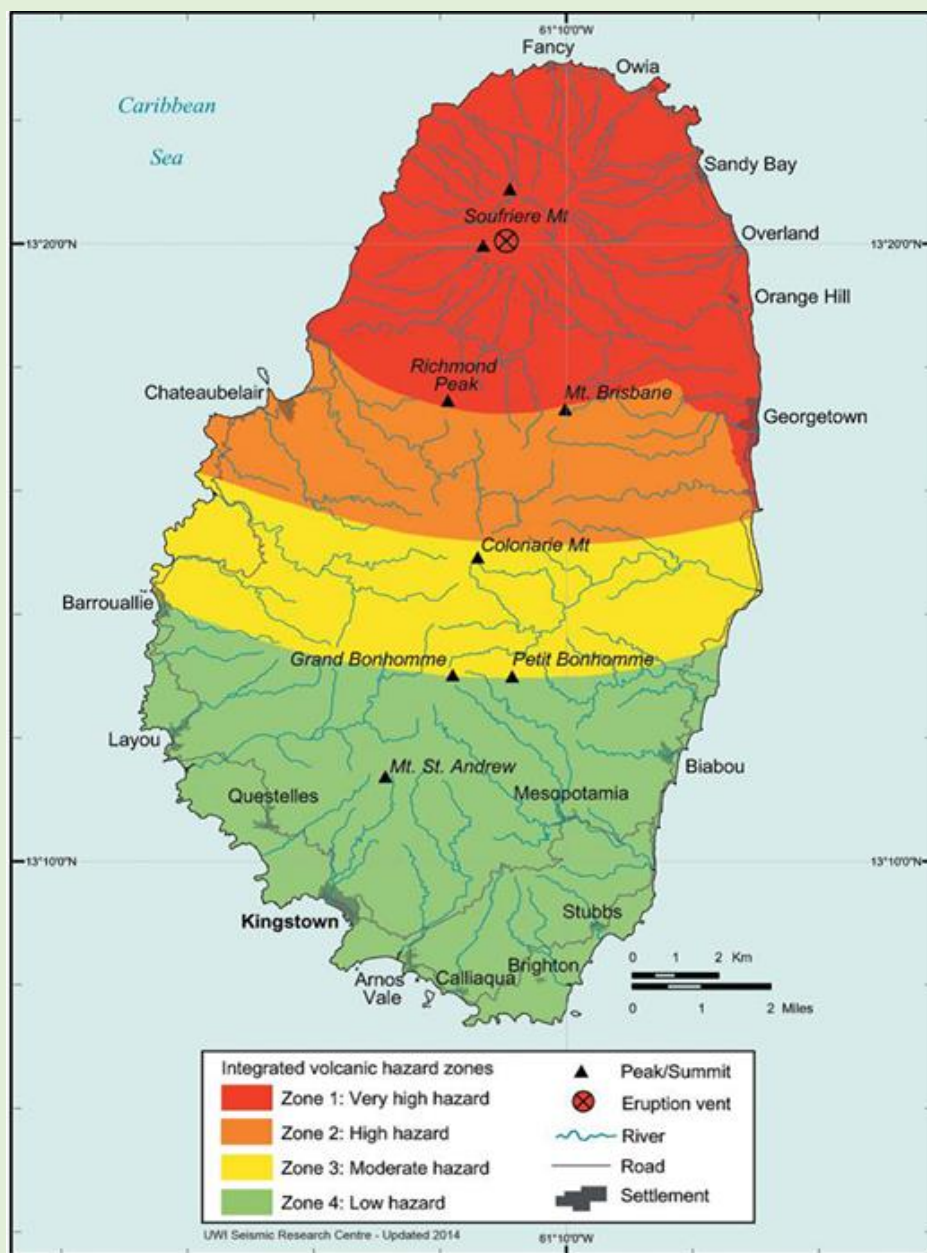
This includes all areas experiencing moderate pyroclastic flow and surges, areas within the 5km projectile zone and areas experiencing between 10 and 30cm of ash fall.

Hazard Zone 3 (Yellow Zone) Moderate Hazard

This area will be free from flows and surges but will receive 5-10cm of ash fall, minor earthquakes and lighting strikes. There will be much less damage than in Zones 1 and 2.

Hazard Zone 4 (Green Zone) Low Hazard

This zone is free from hazard except for a minor fall of ash at less than 5cm. The ash may damage crops and clog up water supplies



Step 2: Divide the class into three equal sections; an *Anticipating an Eruption* section, a *During an Eruption* section, and an *After an Eruption* section. Within each section, ask students to form pairs. Explain that the task of each pair is to create a poster conveying the message(s) of the card they are to be given, targeting younger students from grades 1 to 6. Remind students that an effective poster needs to pass on clear messages use simple, impactful language, and stark images that stick in the beholder's mind. In all decisions they make, they should think about what is likely to grab the target audience's attention. Hand out a card to each pair taken from the respective section of the handout. Follow this by distributing poster drawings or painting materials and giving sufficient time for planning and completing the posters. (30 minutes)

Step 3: Posters completed, ask students to display their poster in the respective wall area marked up for *Anticipating an Eruption*, *During an Eruption* and *After an Eruption*. Invite the class to examine all the posters and afterward hold a whole-class discussion to consider the effectiveness of the posters in conveying volcano-ready messages. Throughout, stress the importance of particular messages and the messages taken as a whole! (20 minutes)

Variation

Begin *Step 2* by showing a sample of volcano awareness and preparedness posters. Ask students to examine each poster closely and to consider the following questions:

- What is the key message conveyed by the poster?
- Are there other messages, hidden or unintended, conveyed by the poster?
- Who are the intended audiences for the poster?
- What makes a poster more or less effective and where does the poster being examined sit on an effectiveness scale of 1-5 (1 being effective, 5 being ineffective)?

Then follow the rest of *Step 2*.

Extension

Invite primary school pupils and their teachers to see the poster display (or take the display to their classes). After the viewing, have your students ask the younger children which posters have grabbed their attention most and why. Have them check, too, whether the primary children have internalized the important messages in the poster. Also, display the posters in a school hallway to raise awareness across the school community and/or display or present the posters at a local community center to raise awareness in the community.

Potential/Facilitation Tips

In this activity, students become familiar with safety measures to be taken in advance of, during and after the eruption of La Soufrière while practicing media literacy skills through creating posters and engaging in a mutual critique of each others' posters. The poster drawing and the presentation of posters to younger

children is an exercise in disaster risk advocacy. In facilitating the whole class discussion during *Step 3*, continue to refer to the Zones to which a particular piece of poster advice is most applicable but reinforce the point that students are likely to move around during their lives and find themselves to a greater or lesser extent and for different periods in each zone. Point out to the class that the activity title is borrowed from the NEMO Volcano Ready Communities Project targeting 12 towns and villages in high-risk zones around La Soufrière volcano: <https://www.caribank.org/newsroom/news-and-events/st-vincent-and-grenadines-gets-volcano-ready-new-project>

Curriculum Links

This activity accords with the Form 2 'Man-Made Systems (Regional) section of the Geography curriculum that, among other hazards, covers volcanoes. The curriculum has the following learning objectives: distinguishing between natural and man-made disasters, explaining disaster preparedness, explaining the development of disasters, including volcanic eruptions, identifying ways in which people can be disaster prepared. The activity also complements the Form 2 Health and Family Life Education curriculum 'Disaster Preparedness' theme. For this theme, students demonstrate the ability to 'analyze the societal impact of natural disasters' by being able to 'conduct research on the economic costs of natural disasters,' 'show understanding of how natural disasters impact the health care system' and 'examine the effects on natural disasters on families and relationships.' The poster focus of the activity meets the Form 2 Creative Arts (Visual Arts) syllabus requirement under the Creating, Interpreting and Presenting heading of drawing on other curriculum areas for art and design purposes.

Volcano-Ready Cards

Anticipating an Eruption

Make a family *Volcano Survival Plan*, so everyone in the family is volcano-savvy and knows what to do if the volcano erupts, how to contact each other, and where to assemble if family members are away from home doing different things. The *Plan* needs to cover *safety/evacuation* and *communication*.

Anticipating an Eruption

Assemble a portable *Volcano Survival Kit* and keep it in your car if you are told to evacuate. It should include non-perishable food, water, a battery-powered or hand-crank radio, flashlights and batteries and goggles and disposable masks for all the family.

Anticipating an Eruption

Know where the nearest public shelter is situated so that you if feel unsafe at home or are told by the authorities to evacuate because of an eruption; you are clear where to go. Know, too, what are the most advisable routes to get to the shelter in a time of the eruption

Anticipating an Eruption

Find out about the particular eruption risks and danger points you face in the local area you live in by talking to people about the 2021 eruption, talking to, local authorities and the National Emergency Management Organization (NEMO) or reviewing their report. Familiarize the family and community with those risks and danger points.

Anticipating an Eruption

It may well be that local authorities and disaster management organizations have sufficient warning in advance that an eruption is imminent, evacuate immediately from Red and Yellow Zones.

During an Eruption

Listen to radio or television for the latest emergency information, and if the authorities issue an evacuation order, evacuate immediately to avoid flying rocks, hot gases, blasts and lava flow. Remember to help your neighbors who may need special assistance – infants, the elderly and those with special needs. Think about vital medications they may need. Think about the safety of livestock and family pets, too.

During an Eruption

In evacuating, pay attention to mudflows, especially near streams and when there is prolonged heavy rain. Look upstream at bridges to see if a mudflow - they move very fast – is approaching, and try to avoid river valleys and low-lying areas.

During an Eruption

If you can't evacuate, protect yourself from falling ash by remaining indoors, with windows, doors and ventilation tightly sealed until the ash settles. Close off chimneys and air conditioning. If you have a breathing condition, stay indoors until health officials say it is safe to go outside.

During an Eruption

To protect against ash, wear long-sleeved shirts and long pants and use goggles or glasses (not contact lenses) to protect your eyes. Wear a dust mask or hold a damp cloth over your face to avoid breathing in ash. Use a handkerchief if you have nothing better. If there is a wind, do not stand where ash will blow towards you.

During an Eruption

If you've stayed indoors and there is a danger of the roof collapsing, go out to clear heavy ash from flat or low-pitched roofs. Only do this with protective clothing. If, for whatever reason, leaving home becomes necessary because of ash build-up, drive slowly to avoid stirring up ash and clogging the car or truck engine. Keep all vehicle windows tightly closed. Always remember it is preferable to avoid driving during heavy ashfall.

After an Eruption

If you are in a Yellow or Green zone, avoid entering a Red or Yellow Zone until authorised by government officials.

After an Eruption

The local authorities will take time to piece together information on what is happening, keep watching TV, listening to the radio, checking the Internet, or using your mobile phone for the latest developments.

After an Eruption

Send text messages or use social media to reach out to family and friends to let them know you are safe. Phone systems are often jam-packed during and after an eruption; therefore, only use phones for emergency calls.

After an Eruption

Follow the advice of authorities about when it is safe to leave the evacuation shelter and return home, continue as much as possible to avoid driving through heavy ash as this will clog engines and stall vehicles, and if you are having problems with breathing and continue to have irritation to your eyes, nose and throat, see a doctor straight away.

After an Eruption

Discuss the eruption experience and decide what lessons should be learnt so that everyone is better protected if another eruption happens. Hold those discussions in the family, at school, at community gatherings and on TV and the radio.

Sources of *Volcano-Ready Cards*: NEMO website

<http://nemo.gov.vc/nemo/index.php/hazards/volcanoes>

<https://www.ready.gov/volcanoes>

<https://www.cdc.gov/disasters/volcanoes/during.html>

Strand 5: Human-Made Hazards & Epidemics

Unit 5: Pollution

Topic 1: Definitions and Categories of Pollution

Activity 13: What is Pollution?

Purpose: Defining pollution and exploring categories of pollution

Time needed: 90 minutes (20 minutes for *Stage 1*; 30 minutes for *Stage 2*; 40 minutes for *Stage 3*)

Resources needed

- A sheet of paper and pencil for each student
- A sheet of chart paper and marker for each group of five students
- A cut-up set of *Pollution Cards* per group

Procedure

Stage 1

Step 1: Ask students working individually and avoiding discussion to complete a sentence beginning 'Pollution is...' on a sheet of paper. The sentence should convey their understanding of what pollution is. (5 minutes)

Step 2: Have students form groups of five persons to share and discuss their definitions. Following the discussion, have them negotiate a mutually agreeable sentence. This should be written in large on their sheet of chart paper. (5 minutes)

Step 3: In a whole-class session, ask each group to share their consensus sentence and take any questions from the rest of the class. Introduce the definitions of pollution given in *Box 11* as and when it seems appropriate. (10 minutes)

Box 11: Pollution Definition

Pollution is the introduction of substances or energy into the environment, resulting in deleterious effects of such a nature as to endanger human health, harm living resources and ecosystems, and impair or interfere with amenities and other legitimate use of the environment.

Source: Taken from European Environmental Agency.

<https://www.eea.europa.eu/archived/archived-content-water-topic/wise-help-centre/glossary-definitions/pollution>

Stage 2

Step 1: Ask the class to form a circle in an open classroom space and, one by one have students think of one type or category of pollution and give a concrete example

from what they have read or heard. Give a lead, as the teacher, with your example, e.g., ‘water pollution – I saw a sewerage pipe leaking into the local river.’ At the end of circle sharing, ask if any types of pollution have been forgotten. (10 minutes)

Step 2: Ask the class to return to their original groups and hand each group a set of *Pollution Cards*. Have them read and think about the cards and ask them to identify ways in which the cards give greater breadth and depth to their understandings of pollution as shared in the circle. Have each group briefly report back what they have discovered. (15 minutes)

Step 3: Ask each group to choose one card and explain that their task ahead of the next lesson is to investigate the pollution category selected and come to class ready to give a 5-minute presentation on their pollution category focusing on concrete SVG experience. They can use posters, pictures, video and sound clips, readings, little dramas, or other media in their presentation. (5 minutes)

Stage 3

Step 1: Have groups present, one by one, what they have prepared and encourage class comments and feedback following each presentation. (40 minutes)

Potential/Facilitation Tips

In *Step 3* of *Stage 1*, encourage the class to identify clear and nuanced differences in understanding pollution, as expressed in the group charts. In *Step 1* of *Stage 2*, make clear that students can repeat a pollution category (e.g., water pollution) but must give a different concrete example. As the activity progresses, aim to show how various pollutions often link together or reinforce each other.

Emphasize that, while there are some natural-caused pollutions - for example, volcanic eruptions cause air pollution - most pollutions are human-caused. They are slow-onset hazards (see *Activity 2*) that people may not recognize until they become extreme.

Curriculum Links

This activity connects with the Form 2 Health and Family Life Education curriculum, where students are required to ‘recognize the adverse consequences of health that result from not protecting the environment or themselves from environmental hazards.’ In achieving this outcome, students need to be able to list and identify hazards in the environment that can affect life and health, devise measures to maintain environmental health at school, and design a plan to lessen the effects created by hazards in the environment.’

Pollution Cards

Air Pollution

Air pollution is the presence of chemicals or compounds in the air that are usually not present and lower the quality of air or cause adverse effects to the quality of life.

Sources: Outdoor air pollution is caused by emissions from coal-burning for power and heat, transport, industrial furnaces, brick kilns, the unregulated burning of waste materials (e.g., plastics and batteries), wildfires, agriculture, dust and sand storms. Air pollution indoors is caused by cooking on stoves, heating, lighting, and chemicals for cleaning purposes.

Effects: Nine out of ten people breathe polluted outdoor air beyond acceptable World Health Organization guidance levels. Air pollution has severe effects on human health, ranging from simple symptoms (e.g., coughing) to acute conditions (e.g., asthma, cancer, chronic lung diseases). Poor air quality causes roughly 7 million deaths every year globally.

Freshwater Pollution

Freshwater pollution is the presence of chemicals and biological agents in levels exceeding what is naturally found in inland non-salty water that may harm human health and the environment

Sources: Pollution in freshwater is caused by a range of nutrients and chemicals used by farmers (fertilizers and pesticides), germs coming from untreated wastewater, and poisonous metals from mining and industrial effluent. Polluted water is more likely to host disease carriers.

Effects: The major impacts include:

Soil and Land Pollution

Soil and land pollution is the presence of toxic chemicals in soil in high enough concentrations to pose a risk to human health and/or the health of ecosystems.

Sources: Soil and land pollution are caused mainly by poor agricultural practices, inefficient irrigation, improper solid waste management, unsafe storage and use of hazardous chemicals and nuclear waste, leaching from mismanaged landfills, and uncontrolled dumping of waste from households, industrial plants and mining.

Effects: Pollutants in land and soil (e.g., lead, mercury, cadmium, antibiotics) degrade land, soils and the underlying aquifers and are hard to remove. Soil and land contamination leads to less agricultural productivity and causes various diseases and even death in humans and wildlife. The contamination goes into the food we eat.

Marine Pollution

Marine pollution is the presence of substances in the marine environment, causing adverse effects to marine ecosystems, human health, and other species' health.

Sources: Human activities on land such as dumping waste along coastlines, littering of beaches, and agricultural runoff are the most significant sources of marine pollution. Floods and other storm-related events flush this waste into the sea. The primary sources of marine pollution include fishing gear, oil spills by ships and legal and illegal dumping of waste by ships.

<p>deterioration of habitats and ecosystems, especially wetlands; the loss of aquatic biodiversity; the spread of waterborne diseases; contamination and blockage of drains by plastics and other improperly contained solid waste.</p>	<p>Effects: Coastal communities face increasing spending on beach cleaning, protecting against coastal health risks, and coastal waste disposal. The fishing industry is hurt by a reduced and contaminated catch. Marine pollution causes biodiversity loss and damages the functioning of coastal and sea ecosystems. Microplastics (tiny particles of discarded plastics) can be digested by small aquatic life. Once digested, the toxins bio-magnify as they move up the food chain.</p>
<p>Noise Pollution</p> <p><i>Noise pollution is regular exposure to loud sound levels that may negatively affect humans or other living organisms.</i></p> <p>Sources: Noise pollution is caused by street and road traffic, railways, aircraft, construction, music and sports events, commercial venues, the loud playing of musical devices.</p> <p>Effects: Noise pollution can be hazardous to human health [e.g., it can lead to hypertension (stress), hearing loss, sleep disturbances, cardiovascular and psychological dysfunctions].</p>	<p>Light Pollution</p> <p><i>Light pollution is the inappropriate or excessive use of artificial light at night.</i></p> <p>Sources: Light pollution is caused by overly bright and excessive lighting, poorly shielded lighting, and, from a human safety point of view, entirely unnecessary lighting. Specifically: exterior and interior lighting on buildings; advertising displays; lights left on after work hours at commercial properties, offices and factories; too much street lighting, highly illuminated sporting venues.</p> <p>Effects: Negative impacts of the brightening night sky include increasing energy consumption, disturbing the ecosystem and wildlife (including diverting birds from their migration routes with resulting loss of life), and adverse effects on human health (e.g., increased risks of obesity, depression, sleep disorders).</p>

Sources: Environmental Pollution Centers. <https://www.environmentalpollutioncenters.org>; UN Environmental Program. (2017). *Towards a Pollution-Free Planet*, http://wedocs.unep.org/bitstream/handle/20.500.11822/21800/UNEA_towardspollution_long%20version_Web.pdf?sequence=1&isAllowed=y; UN Environmental Program. *Pollution*, <http://web.unep.org/environmentassembly/dimensions-pollution>; International Dark-Sky Association. *Light Pollution*. <https://www.darksky.org/light-pollution/>

Strand 5: Human-Made Hazards & Epidemics

Unit 5: Pollution

Topic 2: Pollution Impacts in SVG

Activity 14: Pollution Soapbox Investigation

Purpose: Challenging students with a strong statement on pollution on SVG and having them critically assess the statement's validity through investigation.

Time needed: 50 minutes

Resources needed

- A sheet of chart paper, markers (of two different colours) and glue stick per group of three or four
- One of the four *Soapbox Statements* for each group (i.e., two copies of each *Statement*)

Procedure

Stage 1: Preparations

Step 1: Ask the class what 'standing on a soapbox' means. If students are not forthcoming with an explanation, give your explanation using *Box 12*. (5 minutes)

Box 12: Soapbox

A soapbox is a raised platform on which one stands to make an impromptu speech, often about a political subject. The term originates from the days when speakers would elevate themselves by standing on a wooden crate originally used to ship soap or other dry goods from a manufacturer to a retail store. People listening would often shout critical comments or, in extremis, throw eggs or tomatoes!

Source: <https://en.wikipedia.org/wiki/Soapbox>

Step 2: Explain to the class that they should imagine the statement they receive has been spoken from the soapbox. Go on to explain that their role is to be an investigator or researcher whose job is to scrutinize the content of the soapbox statement and be ready to comment on it from what they have found out. Is every word true? Is there any exaggeration? Are there generalizations that do not hold if we look at the particulars? Are there things the speaker has conveniently left unsaid? Are there counter-arguments to what is being said? Are there things the speaker has overlooked or forgotten? (5 minutes)

Step 3: Have the class form eight groups, each with three or four students. Hand out chart paper, markers, glue stick and one *Soapbox Statement* to each group. Explain that the first of the in-class tasks is for each team of investigators to scrutinize the text of the statement critically. They do this by sticking the statement in the centre of

the chart paper and writing in questions they want to pose around the surrounding chart paper area (using their first colour marker). Then explain that their second task is to identify who they should go to and what sources they should investigate to answer their questions. They are to write their ideas on the chart (using the second colour marker). (20 minutes)

Step 4: Have the groups share their response to the statements with their classmates. End the sharing by giving students ample time to conduct their investigations by talking to relevant people, contacting organizations, searching on the Internet. (20 minutes)

Stage 2: Presentations

Step 1: Give over a complete lesson for each group of students to present their findings (5 minutes per group). How valid did they find the *Soapbox Statement*? End with a whole class discussion. (50 minutes)

Potential/Facilitation Tips

Key to the activity's success is, in *Stage 1*, to encourage critical scrutiny of the given statement. Do this by showing how an investigative detective can take apart a text. In *Stage 1*, too, try to ensure that students are thinking broadly about where and to whom they should take their investigation. With *Stage 2*, have the two groups investigating the same statement present one after the other and encourage the class to identify the differences between the two investigations and why that is. Conclude *Stage 2* by having the class share broad learnings from the activity and think about what makes for an excellent environmental investigation. This activity can make a signal contribution to developing media and political literacy skills.

Curriculum Links

This activity connects with the Form 2 Health and Family Life Education Curriculum, where students are required to 'recognize the adverse consequences of health that result from not protecting the environment or themselves from environmental hazards.' In achieving this outcome, students need to be able to list and identify hazards in the environment that can affect life and health, devise measures to maintain environmental health at school, and design a plan to lessen the effects created by hazards in the environment.'

Soapbox Statements

Not Like the Old Days...

Greener efforts at solid waste management require greater discipline and participation at the household and individual level than currently exists here in St. Vincent and the Grenadines.

Waste separation at source for the Grenadines and the mainland means that residents have to dispose of plastics, glass bottles and cans in separate containers, for pick up on different days. This practice has become second nature for persons living in most developed countries of the world. One wonders how well we can adapt to the requirements of separating kinds of waste and reducing the volume of our waste as they come on stream here.

Regrettably, it seems that many of us, even after years of public education and moral persuasion are still struggling with the concept that littering and illegal dumping are unlawful, unsightly, unhealthy and pose a threat to our tourism industry.

There has long been a call for the authorities to enforce the law in relation to illegal dumping. I join them in their call, as it is clear that there are some among us who show total disregard for efforts to have an orderly, safe society, and only comply when they are made to.

What is interesting is that what we are being called on to do today, is what our parents and grandparents did 40 or more years ago, without being forced to. There was a time when Kingstown had the reputation of being the cleanest capital in the West Indies. What went wrong? Why is it so difficult for us to take responsibility for our own health and well-being?

Dirty Kingstown

Kingstown is dilapidated, dirty, polluted, has poor air quality and stinks. Many Vincentians have complained about how disgusting Kingstown looks and smells. Kingstown is a city of filth. There is a lot of litter around, and the drains are usually blocked and stinking. Vincentians are being exposed to dirty air, and unwittingly breathing in tiny particles of dust and rubbish.

We have seen that in times of heavy rain, litter in Kingstown often accumulates and blocks the drains. This leads to flooding and an increase in breeding sites for mosquitoes. Given that SVG is dealing with an outbreak of Chikungunya, which is spread by mosquitoes.

Many Vincentians who live abroad, say that they are disgusted by the dirty state of Kingstown when they come back on holiday. SVG should follow the example of countries such as Singapore, Norway and Sweden. They have very clean streets and a high-quality living environment for their people.

A Tyre-some Matter

Most weeks, truck-loads of tyres are taken to the Rabacca area and burned. It is very worrying, seeing the black and dirty smoke being blown into our drinking water catchment areas and all over the homes in the area and beyond.

Burning tyres releases a toxic soup of hundreds of pollutants. There is over 7 litres of petroleum and oil in one tyre, and numerous chemicals including chlorine, styrene, butadiene and more than 20 different heavy metals.

The burning of tyres is madness in two ways: firstly, our people and water are being poisoned; and secondly, recycling the waste tyres could be a multi-million-dollar industry for our country and create hundreds of jobs. This lack of vision means our people are being poisoned and impoverished simultaneously by these burning tyres.

We can use this rubber to build roads. Recycled tyres can also be used to make items such as chairs, tables, roof tiles, belts, hats, handbags, children's swings, footwear, baskets, artwork to sell, jewellery and flooring. There is an opportunity here for lots of small businesses to be set up to export these types of products. This can create millions for our people and bring lots of jobs.

Noisy SVG

An area screaming for attention is that of noise pollution. This is a problem which has been with us for a number of years, and which has gone completely out of control. In spite of the law (the Noise Act) noise pollution has continued unabated and there are new threats to the peace and quiet of the society.

Today the nuisance arises not only from music from entertainment events but also from vehicles, blaring music at a decibel level enough to deafen even the hearing impaired. It is as if we have become victims of our own 'success', showing off how much noise we can get our music sets to generate. Add to this, the growing practice among motor enthusiasts to equip their vehicles with extra exhaust equipment, designed to be as loud as possible, and you get a picture of the scale of the threat.

Even though we are experiencing this problem, and complaints have been increasing from citizens, little action has been taken to arrest the problem. What is the point of having legislation on our books, if it is not being enforced?

Sources: *Searchlight. Editorial. Taking Care of Our Solid Waste – Who Can't Hear, Must Feel.*
<https://searchlight.vc/searchlight/editorial/2012/01/20/taking-care-of-our-solid-waste-who-cant-hear-must-feel/>;

Searchlight. Editorial. Implement Noise Act to Deal with Noise Pollution
<https://searchlight.vc/searchlight/editorial/2011/09/27/implement-noise-act-to-deal-with-noise-pollution/>;

Vincentian. Green Party View: Kingstown – Dilapidated, Dirty, Polluted and Stink
<http://thevincentian.com/green-party-view-kingstown-dilapidated-dirty-polluted-and-stink-p6539-107.htm>;
Vincentian. Green Party View – Our People are Being Poisoned
<http://thevincentian.com/green-party-view-our-people-are-being-poisoned-p3971-107.htm>

Strand 5: Human-Made Hazards & Epidemics

Unit 5: Pollution

Topic 3: Pursuing Advocacy and Action

Activity 15: Tackling Pollution

Purpose: Practicing advocacy skills through letter writing by outlining their views on a particular pollution case known to students and calling for action

Time needed: 80 minutes

Resources needed

- A few sheets of letter paper per group of three

Procedure

Stage 1: Articulating Our Need

Step 1: Ask students to stand in two circles (those in the inner circle facing outwards and those in the outer circle facing inwards so that the pair of students are facing each other). Tell them that each member of the pair is first to complete a sentence in their mind without discussion. Say aloud the following sentence beginning: 'We need clean air because...' and give one minute for each student to complete the sentence in their mind. Then ask students facing each other to share the sentence and follow this with some conversation. (5 minutes)

Step 2: Give a signal and ask each student to move one step to the right to face a second partner. Say aloud the second sentence beginning: 'We need darkness at night because...'. After having students complete the sentence in their mind, repeat the same process as described in *Step 1*. (5 minutes)

Step 3: Give a signal and ask each student to move one step to the right to face a third partner. Say aloud the third sentence beginning: 'We need clean soil because...' After having each student determine their sentence quietly, repeat the same process. (5 minutes)

Step 4: Give a signal and ask each student to move one step to the right to face a fourth partner. Say out loud that the fourth sentence beginning: 'We need a quiet environment because...' After having each student decide how to complete the sentence, repeat the same process. (5 minutes)

Step 5: Give a signal and ask each student to move one step to the right to face a fifth partner. Say out loud that the fifth sentence beginning: 'We need a clean marine environment because...' After having each student decide how to complete the sentence, repeat the same process. (5 minutes)

Step 6: As a whole group, discuss what they have learned. Have their attitudes been confirmed or challenged? Did they come across any surprises? (10 minutes)

Stage 2: Writing Letters to Stop Pollution

Step 1: Have students form groups of three. Explain that their task is to draft a formal letter to someone who is in a position to bring about change (for instance, a local MP or a representative of the Town Board, the District Board, or the Village Council) urging urgent action on one case of pollution about which students feel very concerned. Tell them that the letter should outline the leading causes and effects of the chosen pollution case and urge a solid and urgent solution to the pollution case in as persuasive a way as possible. (25 minutes).

Step 2: Invite each group to read their letters aloud in class. Encourage others to give constructive peer feedback to improve the letter. Make sure that you also provide specific feedback at the appropriate point. End with a whole class discussion. Keep asking how they can make their letter as effective as possible. (20 minutes)

Extensions

1. Have each group revise their letters by considering the comments received and conducting further research, as necessary. Once completed, have them send their letters to the person identified.
2. If and when the replies are received, have the class share and discuss the responses. Are the answers satisfactory? Specific enough? Convincing? Is there a case to write a second letter?

Variation

1. In *Stage 2, Step 1*, have students focus on the issue of Persistent Organic Pollutants (POPs), drawing upon information from *Box 13* as appropriate).

Box 13: Persistent Organic Pollutants (POPs)

- Persistent Organic Pollutants (POPs) are a genre of toxic chemicals that are persistent in the environment and last for several years before breaking down. The most commonly encountered POPs include organochlorine pesticides (e.g. DDT), industrial chemicals, most notably polychlorinated biphenyls (PCB), unintentional by-products of many industrial processes (especially polychlorinated dibenzo-p-dioxins or PCDD and dibenzofurans or PCDF, commonly known as 'dioxins').
- POPs circulate globally, and chemicals released in one part of the world can be deposited at far distances from their source through a repeated process of evaporation and deposition. POPs can be found in most parts of the Caribbean region, including locations far from the pollution sources.
- POPs bio-magnify throughout the food chain and bio-accumulate in organisms, so the highest concentrations of POPs are found in organisms

at the top of the food chain (e.g. Fish, predatory birds, mammals and humans). They are therefore at highest risk from acute and chronic toxic effects.

- Human exposure even to low levels of POPs can lead to, among other things, increased cancer risk, reproduction disorders, alternation of the immune system, neuro-behavioural impairment, endocrine disruption, genotoxicity and increased birth defects.
- Many of the countries in the Caribbean region have signed and/or ratified the *Stockholm Convention on Persistent Organic Pollutants* which aims to reduce release of POPs chemicals on a global basis. SVG ratified the *Convention* in September 2005 and went into force in December 2005.

Sources: Stockholm Convention. <http://chm.pops.int/default.aspx>; UN Environment Program/Caribbean Environment Program. Persistent Organic Pollutants (PoPs) and Pesticides. <http://cep.unep.org/publications-and-resources/marine-and-coastal-issues-links/persistent-organic-pollutants-pops-and-pesticides>; World Health Organization. Food Safety. Persistent Organic Pollutants (POPs) https://www.who.int/foodsafety/areas_work/chemical-risks/pops/en/

2. Have each student write their letter individually in *Stage 2* using class time or as homework.

Potential/Facilitation Tips

Activities 13 and 14 and *Step 1* of this activity will help prepare students to write their advocacy letter and allow them to research further if necessary. Encourage them to focus on a pollution case in their own locality or one that has been negatively impacting them personally so that they can include their personal experiences and feelings in the letter.

Curriculum Links

This activity connects with the Form 2 Health and Family Life Education Curriculum, where students are required to ‘recognize the adverse consequences of health that result from not protecting the environment or themselves from environmental hazards.’ In achieving this outcome, students need to be able to list and identify hazards in the environment that can affect life and health, devise measures to maintain environmental health at school, and design a plan to lessen the effects created by hazards in the environment.’ In a general way, this activity contributes to developing letter writing and textual preparation skills as demanded by the English curriculum.

Strand 6: Planning for Disasters

Unit 6: School

Topic 1: School HVCA

Activity 16: Assessing Our School's Hazard, Vulnerability and Capacity

Purpose: Exploring hazards that the school might face; identifying the school's vulnerability and capacity to prevent and mitigate disaster

Time needed:

- 155 minutes (*Stage 1*: 50 minutes plus a varying amount of time to communicate with NEMO/Red Cross; *Stage 2*: 105 minutes)

Resources needed

- A copy of the *School Hazard Assessment* handout for each group of four or five students
- A copy of the *School Vulnerability and Capacity Checklist* handout for each group
- Chart paper and different colour markers for each group of four or five students

Procedure

Stage 1: School Hazard Assessment

Step 1: Ask students to form groups of four or five. Give each group a copy of the *Hazard Assessment* handout. Focusing on their school context, ask each group to allocate what they consider an appropriate number for each category according to the criteria included in the handout. Encourage the students to do this based on their current knowledge and previous experience. Once completed, have them come up with a score for each hazard and reflect on what the scores tell them about prioritizing hazards in promoting school safety. (15 minutes)

Step 2: Have each group briefly share key discussion points. Then facilitate a whole class negotiation of a score for each hazard and have them decide which hazards should be prioritized for the school. Make a list of questions emerging from this exercise. Compile the results and key points discussed on the board. (20 minutes)

Step 3: Share a summary of the class discussion with NEMO or other relevant agencies (e.g., Red Cross) for their feedback and comments. Once a response has been received, have the class reflect on the comments and their implications for promoting school safety. (Allow a varying amount of time to communicate with a relevant agency, followed by 15 minutes for class discussion)

Stage 2: School Vulnerability and Capacity Mapping

Step 1: Give each group a sheet of chart paper and different colour markers. Tell them that their first task is to draw an outline map of the physical school environment (i.e., buildings, classrooms, school ground areas, entrances and exits) and indicate the four compass directions (i.e., north, south, west and east). Assign one or two priority hazards identified in *Stage 1* to each group. Once the outline map is drawn, explain that they will use it to depict the weaknesses and strengths in the face of the assigned hazard(s) identified by the vulnerability and capacity assessment to be conducted shortly. (10 minutes)

Step 2: Give each group a copy of the *School Vulnerability and Capacity Checklist* handout. Explain that using Section A of the handout their task is to go around the school in groups to observe and assess the weaknesses of the school environment in the face of the assigned hazard(s). Explain that they should fill in the form as they go along. (20 minutes)

Step 3: Back in class, ask students to write down their findings in the school map created in *Step 1 of Stage 2*. (10 minutes)

Step 4: Ask each group to look at Section B of the handout. Explain that the table includes examples of items and facilities that can be called upon during a time of emergency and disaster. Focusing on the same hazard(s) assigned earlier, have them brainstorm other items which could be called upon and write them down. Hold a brief whole-class reporting session. (10 minutes)

Step 5: Ask each group to go around the school to discover the locations and to assess the quality/condition of the items/facilities indicated in Section B. Remind groups that they should fill in the form as they go along. (20 minutes)

Step 6: Back in class, ask students to write down their findings in the school map created in *Step 1*. (10 minutes)

Step 7: Have groups hang their charts on the classroom wall and invite everyone to examine each other's work, groups at all times leaving a 'host' available to explain their work to 'visitors.' (10 minutes).

Step 8: Hold a whole-class discussion. Have students reflect on the differences and similarities in the work of different groups. Have the class consider the implications of the findings to protect better the school community from potential hazards. (15 minutes)

Variation

In *Stage 2*, divide each group into two sub-groups and give each sub-group a copy of the *School Vulnerability and Capacity Checklist* handout. Assign each sub-group, either Section A or Section B, to investigate and have each sub-group conduct assessments in parallel. Once the investigations are completed, each group puts their sub-group findings in the same outline map.

Potential/Facilitation Tips

A Hazard, Vulnerability and Capacity Assessment (HVCA) in school helps students identify the most relevant hazards and raise their awareness of the school's physical environment vulnerable to potential hazards and some of the capacities the school already has to mitigate impacts of potential hazards.

In *Step 1* and *Step 2* of *Stage 1*, a hazard assessment is conducted based on students' existing knowledge and perceptions. It is essential to complement this process by engaging with those with scientific and technical knowledge and expertise in the field (e.g., MoE School Safety, NEMO, Red Cross). Communication with the chosen agency can be made from a distance (by email, fax, or Skype). Alternatively, invite a relevant officer to class. In either case, liaise with the agency well in advance about possible and realistic engagement option(s), dates and availability. Another way forward is to invite adult members from the School Disaster Management Committee to class to comment on student hazard assessment findings.

During *Step 2* and *Step 5* of *Stage 2*, arrange, if necessary, to have relevant school personnel available (e.g., school principal, school caretakers) so that students can ask them for information that they cannot find by just observing.

It is essential to ensure that student knowledge and skills are developed through this participatory HVCA process and applied to ongoing school disaster management planning and action.

Curriculum Links

This activity can be used to complement the Disaster Preparedness theme of the Form 2 Health and Family Life Education curriculum. It also works with the Man-Made Systems (Regional) section of the Form 2 Geography curriculum, which contains a sub-section covering several hazards (e.g., hurricanes, floods, droughts, earthquakes, volcanic activities and tsunamis). This activity addresses one of the sub-sections learning outcomes: 'identifying ways in which people can be disaster prepared.'

Handout: School Hazard Assessment

Hazard types		(A) Hazard Probability	(B) Hazard Frequency	(C) Scale of Impact (area/peop le)	(D) Severity/ Magnitude of Damage (D)	Score: A x B x C x D
		5: Highly likely 4: Likely 3: Somewhat possible 2: Unlikely 1: Highly unlikely	5: more than once a year 4: Once every one to two years 3: Once every three to four years 2: Once every five to ten years 1: Once over 10 years or unknown	5: Entire school 4: About half the school 3: Few classes 2: One class 1: A few students	5: Extensive 4: Major damage 3: Minor damage/injuries 2: Minimal damage 1: No physical damage	
Natural	Hurricanes & Tropical Storms					
	Earthquakes					
	Flooding					
	Drought					
	Tsunami					
	Volcanic eruption					
	Landslide					
Human-induced	Fire					
	Pollution					
	Deforestation					
	Disease outbreak					
	Violence at school					
	Traffic accident					
	Drug abuse					

Source: Adapted from Ministry of Education, Government of St Vincent and the Grenadines (2017). *School Disaster Management Plan. 7.*

Handout: School Vulnerability and Capacity Checklist

Hazard(s) considered: _____

A: Vulnerability Check

	Quality/ Condition (1: poor quality/need repair; 2 = reasonable quality; 3= good quality)	Potential impacts from the chosen hazards
Roofs		
Building foundation		
School perimeter walls		
Interior walls		
Windows		
Stairs		
Corridors		
Classroom furniture		
Classroom floor		
Entrance/exits for rooms		
Route from room to school grounds		
Water facilities		
Latrines		
Garbage correction facility		

B: Capacity Check

<p>School facilities, equipment and materials <i>[Add additional facilities, equipment and materials in the blank spaces below]</i></p>	Location(s)	Quantities (if appropriate)	Quality/Condition (1: poor quality/need repair; 2 = reasonable quality; 3= good quality)
Emergency assembly area(s)			
Gas, electricity and water shut off locations			
Signs for building evacuation routes			
Fire extinguishers			
First aid materials			
Stretchers			
Torches			

Strand 6: Planning for Disasters

Unit 6: School

Topic 2: Developing Student Disaster Risk Reduction Action Plans

Activity 17: Making Our School More Prepared for Disasters

Purpose: Based on the HVCA conducted (in *Activity 16*), developing student-led disaster risk reduction action plan(s) for the school

Time needed: 50 minutes plus varying action implementation time outside of lesson time

Resources needed

- Vulnerability and Capacity Maps as created in *Activity 16*

Procedure

Stage 1: Action Planning

Step 1: Have students re-form the groups assembled for *Activity 16*. Ask each group to review their vulnerability and capacity map and discuss and determine a few key issues they feel most important to address to make the school community safer from identified prioritized hazards. Have them clarify the reasons why they think the chosen issues are important. (10 minutes)

Step 2: Have each group share what they have determined and jot down the issues on the board. Once completed, have the class examine the list of issues and negotiate one or two issues on which the class would like to take action. Facilitate the class in working out an action plan by detailing the objectives of the action, the action steps and roles and responsibilities, deciding who does what and when. Keep notes on what has been agreed. (20 minutes)

Stage 2: Implementation

Have the class implement the action plan. (Varying action implementation time)

Stage 3: Reflection

Once the plan is implemented, hold a class discussion to reflect on their action plan implementation experiences. (20 minutes)

Variation

Have each group develop their action plan, implement it, and reflect on their implementation experience.

Potential/Facilitation Tips

This activity allows the class to plan and implement a concrete student-led DRR action at school. Make sure that everyone has a part to play in implementing the action plan.

Also, ensure that student-led DRR action is linked to ongoing school disaster management initiatives. This can be done by, for instance, having students report what they have done to the school disaster management committee, embedding student action planning in the school disaster management plan, and by having school disaster management committee members work alongside the students. It is vital that student action is not just tokenistic but is valued and seen to be valued as a critical part of school disaster management. This activity provides a vivid experience of citizenship education, rights and responsibilities.

Curriculum Links

This activity can be used to complement the Disaster Preparedness theme of the Form 2 Health and Family Life Education curriculum. It also complements the Man-Made Systems (Regional) section of the Form 2 Geography curriculum, which contains a sub-section covering several hazards (e.g. hurricanes, floods, droughts, earthquakes, volcanic activities and tsunamis). This activity addresses one of the sub-section's learning outcomes: 'identifying ways in which people can be disaster-prepared'.

Strand 6: Planning for Disasters

Unit 6: School

Topic 3: Disseminating and Advocating for School Disaster Management Plans

Activity 18: Disseminating Our School Disaster Management Plan

Purpose: Familiarizing students with the school disaster management plan; creating a student-friendly version of the school disaster management plan for wide dissemination across the student community

Time needed: 50 minutes

Resources needed

- A copy of the school disaster management plan per group
- Sheets of chart paper, A4 paper and colour markers.

Procedure

Step 1: Explain that the school has a developed disaster management plan and introduce its purpose and assumptions using the text from the school's plan (or drawing upon the information in *Box 14*). (5 minutes)

Box 14: Purpose of the School Disaster Management Plan

The purpose of the plan is to outline actions to be taken by the school community including staff, students, parents and other users of the school in the event of a hazard or emergency.

The aim of the plan is to:

- Prevent disasters and reduce vulnerability to hazards
- Establish guidelines which can be used to protect people and property from the impacts of hazards
- Respond effectively to threats or emergencies that arise at the institution
- Prepare for recovery after a disaster to return to a better state than before the impact

Source: Ministry of Education, SVG. (2017). *School Disaster Management Plan*. 1.

Step 2: Ask students to create groups of three or four and explain that their task is to create a 'student-friendly version' of the School Disaster Management Plan so that key messages from the plan are communicated in a clear and reader-friendly way so they are understood well by students. Assign each group a section from the plan and have them decide on the medium/method they would like to use (e.g. poster, brochure, skit, song). Encourage them to creatively adjust, expand, and/or reduce the given text to understand key messages. (30 minutes) easily.

Step 3: Invite each group to present what has been produced and encourage others to comment. Hold a whole-class discussion. (15 minutes)

Extensions

1. Have each group display what they have produced at prominent places and widely used thoroughfare points within the school (with appointed times when the students will take charge of the display) and/or present them at a school assembly or other gatherings.
2. Have students plan a drill in response to one or more of the hazards they worked on with their colleagues. What are the key things they would need to put in place and prepare? How would the school community best be warned of the hazard? Where would students go and what route would they take? What would happen when they got there? Have groups discuss before sharing their ideas with the class. Then, compare and contrast their ideas with the appropriate sections of the School Disaster Management Plan.

Potential/Facilitation Tips

School disaster management plans are often written by and for adult school stakeholders and not for the students, so it is important to translate the language and format in the plan into something more accessible for the student community.

For *Step 2*, focus on the section(s) most relevant to the students, e.g., the ‘Action for Selected Hazards’ section of the school disaster management plan, and assign different hazard section(s) to different groups.

It is a good idea to consult with a member of the School Disaster Management Committee (SDMC) before this lesson to decide on which sections of the school disaster management plan should be chosen for this activity so that student activities will complement SDMC’s efforts to disseminate the plan widely among the school community.

Curriculum Links

This activity can be used to complement the Disaster Preparedness theme of the Form 2 Health and Family Life Education curriculum. It also complements the Man-Made Systems (Regional) section of the Form 2 Geography curriculum which contains a sub-section covering a number of hazards (e.g., hurricanes, floods, droughts, earthquakes, volcanic activities and tsunamis). This activity addresses one of the sub-section’s learning outcomes: ‘identifying ways in which people can be disaster-prepared’. Additionally, the activity complements one of the achievement indicators of Visual Arts in the Form 2 Creative Arts curriculum, i.e., ‘create visual images to communicate ideas and information.’ Furthermore, the activity complements one of the achievement indicators in the Form 2 English curriculum, i.e. ‘make postcards, posters, comics, bumper stickers and news headlines on adapting to climate change for different audiences.’

Strand 7: Marine Environment
Unit 7: Mangrove and Coral Reefs
Topic 1: Mangrove Destruction

Activity 19: Magnificent Mangroves!

Purpose: Familiarizing students with mangrove forests, the multiple benefits they bring and, consequently, the many negative impacts arising from their destruction.

Time needed: 100 minutes spread over a suggested two lessons, one stage per lesson (*Stage 1:* 40 minutes; *Stage 2:* 60 minutes)

Resources needed

- Small collection of mangrove forest photos (large enough for the whole class to see)
- Accessibility to Internet film on mangrove swamps: Brighton Mangrove Swamp video https://www.youtube.com/watch?v=0WdCE_NObvc; (1:00 minute); and video, Mangroves: Poetry of Protection published by Open Road India: <https://www.youtube.com/watch?v=NMpdGYZ29-8> (5:57minute)
- Cut-up set of *Benefits of Mangroves* cards for each group of three or four students

Procedure

Stage 1: Introducing Mangroves

Step 1: Ask the class to share what they know about mangrove forests or, as they are sometimes called, mangrove swamps. Do they know what they are? Have they visited any? What did they see and experience there? What kinds of mangrove trees are there on SVG? What benefits do mangrove forests bring? What has happened to them, and with what outcomes? (10 minutes)

Step 2: Show some photographs of SVG mangrove swamps and/or the SVG and India films on mangroves listed under *Resources* above. Ask for thoughts and feelings elicited by the photos and films (after each film you might ask them to think of one word that would best describe their thoughts and feelings and have everyone share those words). If you have shown it, ask why the Indian film is called *Poetry of Protection*. (20 minutes)

Step 3: Fill in any gaps in student knowledge by giving a short input, drawing, as necessary, on the information given in *Box 15* below. (10 minutes)

Box 15

A *mangrove* is a tropical and subtropical shrub or small tree that grows in slow-moving, salty seawater, covered at high tide but uncovered at low tide, in which muddy sediment accumulates. A coastal habitat with lots of mangroves, other shrubs and other small trees is called a *mangrove swamp* or *mangrove*

forest or mangrove ecosystem. There are about 80 species of mangrove worldwide. The total mangrove swamp area around the world covers about 53,200 square miles spread across 118 countries and territories.

Mangrove swamps used to cover vast areas of the Caribbean coastline but they have come under serious threat from human activity. This holds true for St. Vincent and the Grenadines where only scattered patches of mangrove swamp remain across different islands (on St. Vincent itself only 3.88 acres of mangrove remain).

Causes of mangrove destruction on SVG include: harvesting for charcoal, sand mining, coastal dredging, pollution from sewage, overfishing combined with the use of destructive fishing gear, and destroying mangrove coastline by infilling the swamps and obstructing water flows for the purpose of building tourist facilities.

Species of mangrove in SVG are:

- *The Red Mangrove* – found closest to the water with aerial ‘prop’ roots from high up the trunk or even branches that support its weight
- *The Black Mangrove* – with finger-like projections sticking out of the water and found deeper in the mangrove forest where there is less tidal action
- *The White Mangrove* – found more inland and at the edge of the mangrove swamp with no visible aerial root system
- *The Buttonwood or Button Mangrove* – a shoreline tree commonly classed as a mangrove tree that is not really a true mangrove but a close relative

Stage 2: Benefits of Mangroves

Step 1: Have the class divide into groups of three or four and hand a set of *Benefits of Mangroves* cards to each group. Explain that their task is to discuss the cards and try to agree on the relative importance of each of the benefits described on the cards. They should signify their decisions by laying the cards sequentially from *Least Important* to *Most Important* along a line. (15 minutes)

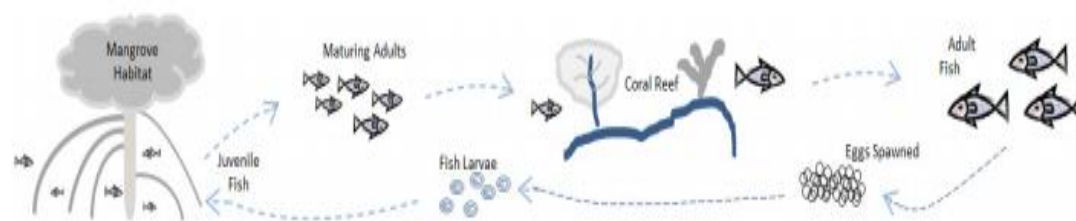
Step 2: Have each group join together with another group to share, discuss and explain their ordering of benefits to try to reach a consensus on the ordering (they can, alternatively, make a case not to order but juxtapose the cards in some other arrangement). (15 minutes)

Step 3: Have each combined group report on critical issues raised in their discussion, their ordering (or non-ordering) of the cards, and the reasons lying behind what they have done. Follow this with a summary whole-class discussion. (30 minutes)

Potential/Facilitation Tips

First, involving finding out what students know and do not know about mangrove forests, this two-lesson activity fills in the gaps in their knowledge before having them consider and assess the various benefits accruing from mangroves. The linear ordering in the card activity is a device to provoke discussion and groups refusing to order the cards in such a mechanistic way will be vital to opening the idea of mangroves bringing a web of interconnected benefits. In the vital final step of the activity (*Stage 2, Step 3*), it is vital to keep turning each benefit on its head by asking the class to consider what threats or risks mangrove loss brings. Keep provocatively asking, 'so what threats do we now face that we did not face when mangroves were common?' This may create an opening for the first discussion of mangrove restoration on SVG (see *Activity 21*). In any discussion of the Coral Reefs card, it may be helpful to share the diagram below with the class.

Diagram: Life Cycles that Combine Mangrove Swamps and Coral Reefs



Source: <http://mangrove.org/video/Coral.pdf>

In preparation for facilitating this activity, read *Case Study 1: Mangrove Restoration on St. Vincent and the Grenadines* in the *Resource Manual*.

Curriculum Links

This activity complements the first Form 2 Earth Science theme of the Integrated Science and Technology curriculum, 'Earth's Weather and Climate' in which students examine the notion of an ecosystem, look at interrelationships within an ecosystem, and explore the impact of climate change on ecosystems

Benefits of Mangrove Cards

<p>Carbon Storage</p> <p>Mangroves are important in combatting climate change because they store up carbon (what is called carbon sequestration) – storing five times as much carbon as do rainforests and slowing the rise of CO2 levels in the atmosphere.</p>	<p>Nurseries</p> <p>Mangroves provide protected nursery areas for juvenile fish, crustaceans and shellfish. Experience shows that restoration of mangroves increases fish and seafood catches.</p>
<p>Storm Protection</p> <p>Mangrove forests provide a vital buffer for coastal areas and built environments against high tides, storm surges and flooding, especially during hurricanes and tsunamis. They are essential to disaster risk reduction.</p>	<p>Tourist Attraction</p> <p>Mangrove swamps are a significant attraction to eco-tourists who come to see the wide variety of wildlife and pristine; they attract tourist income for SVG.</p>
<p>Coral Reefs</p> <p>Mangrove forests protect the rich wildlife of coral reefs by providing critically important nursery grounds for juvenile coral reef fish. Studies have shown that coral reefs are richer in natural life if associated with mangrove tidal wetlands. Mangroves thus support the beauty and financial benefits (commercial fishing, sports fishing, snorkeling/scuba diving, eco-tourism) arising from coral reefs. For this reason, they indirectly help the nearby village and town tourist locations.</p>	<p>Antidote to Land Pollution</p> <p>Mangroves reduce coastal water pollution in that the mangrove swamps act as a buffer, trap, or biological filter against land-based pollution, including chemicals, heavy metals, and inorganic nutrients (fertilizers) discharging into the sea</p>
<p>Protection of Bio-diversity</p> <p>Mangroves harbor and protect a vast diversity of fish, shellfish, insects, amphibians, birds and mammals that inhabits the swamps and forests. Animals find shelter there; branches serve as rookeries (nesting areas) for coastal birds. Migratory birds find shelter as they fly their migration routes.</p>	<p>Ecosystem Support</p> <p>Mangroves slow water flow trap and recycle sediments and organic matters. They act as the basis for a food chain of marine life by providing rotting detritus (decaying leaves, twigs and branches) that species low in the chain feed on.</p>

Psychological/Spiritual Support

Mangroves offer an easily accessible environment where humans can commune with, immerse themselves in and find beauty in nature, so restoring their souls away from the busyness and pressures of everyday life.

Place of Attachment

Mangrove trees provide attachment for marine organisms such as barnacles and oysters. Many of these animals filter water and trap and siphon off pollution.

Strand 7: Marine Environment
Unit 7: Mangroves and Coral Reefs
Topic 2: Coral Reef Protection

Activity 20: The Threat to Coral Reefs

Purpose: Familiarizing students with coral reefs and the threats they are facing

Time needed: 70 minutes

Resources needed

- Internet access to the *Breath-taken Reefscapes* video available on YouTube: https://www.youtube.com/watch?v=Wrlur8zsl_w (24:53 minutes)
- Internet access to the *Chasing Coral* time-lapse video on YouTube: <https://www.youtube.com/watch?v=QltN3FjwTu0> (3:35 minutes)
- A copy of the handout *Coral Reefs on St Vincent and the Grenadines* for each group of three or four students

Procedure

Step 1: Ask the class to share about coral reefs. Have they swum among them? What did they see? What was the experience? Do they know what they are? How are they made? Do they know anything of the present state of coral reefs globally? (10 minutes)

Step 2: Show several minutes of the *Breath-taken Reefscapes* video listed in the above *Resources* section, illustrating the beauty of coral reefs. Ask for students' thoughts and feelings in response to the film. (20 minutes)

Step 3: Give a short input on coral reefs drawing on the information in *Box 16* below. Show the short bleaching time-lapse video listed in the *Resources* section above as you discuss coral bleaching. (10 minutes)

Box 16: Coral and Coral Reefs

Coral branches are made up of thousands of tiny animals called 'polyps'. They are not made of rock are a collection of millions of animals. Each polyp, no bigger than a pinhead and soft-bodied, takes calcium carbonate (limestone) from seawater and builds around itself a hard skeleton for protection.

Coral reefs are believed to have the highest biodiversity of any ecosystem on the planet, even more than tropical rainforests. Occupying less than one percent of the ocean bed, coral reefs are home to more than twenty-five percent of all marine life. An estimated six million fisherman in 99 reef countries and territories – a quarter of all small-scale fisherman – harvest their catch from coral reefs.

More than 60% of the world's coral reefs are under immediate and direct threat from local sources such as overfishing, the use of destructive fishing techniques harming the seabed, coastal development, too much tourism, pollution entering the sea from rivers, marine-based pollution and damage to the seabed from the anchors of yachts and other pleasure boats.

Climate change is causing sea surface temperatures to rise. This leads to mass coral bleaching in which the algae that corals need in their tissues to give them colour are expelled. This stress response to warming water can weaken or kill coral. It has occurred in every coral reef region around the world and is becoming more frequent as sea temperatures rise. Carbon dioxide – the greenhouse gas - is also making the sea more acidic, slowing coral growth rates and weakening coral skeletons.

Step 4: Ask students to turn to those sitting close to them so they make up groups of three or four and give each group a copy of the handout. Give them the task of suggesting and listing practical steps that might be taken to reduce the threat to coral reefs, writing their ideas down on notepaper. (15 minutes)

Step 5: Have groups report back and then hold a class discussion (15 minutes)

Extension

Set the following as homework reading. Then during the next lesson, hold a class discussion on what particularly impressed students in what they read:

- *Reefs in St. Vincent and the Grenadines:* <http://climateandreefs.org/st-vincent-and-the-grenadines>
- *St. Vincent and the Grenadines Coral Reef Report Card 2016:* https://www.nature.org/media/coral-reef-report-cards/SVG_Report_Card_2016_WebLowRes.pdf

Potential/Facilitation Tips

This activity involves first inviting students to share what they know about coral reefs and to describe any close encounters they have had with the reefs. It goes on to look at pristine reefs through video material before focusing through input on why coral reefs are in trouble around the world. It then turns to the SVG situation, in particular, ending with students making practical proposals to protect local reefs. It is important in the closing class discussion to differentiate between 'local' or 'immediate' threats for which it is somewhat easier to think of potential solutions against the 'distant' and 'hard to grasp' but 'real' threats posed by climate change and climatological breakdown.

Curriculum Links

This activity complements the first Form 2 Earth Science theme of the Integrated Science and Technology curriculum, 'Earth's Weather and Climate,' where students

examine the notion of an ecosystem, look at interrelationships within an ecosystem, and explore the impact of climate change on ecosystems.

Handout: Coral Reefs on St Vincent and the Grenadines

St Vincent has few coral reefs. The Grenadines have more. The reefs are still relatively healthy but face a number of severe threats from human activities:

- The most common threat is commercial overfishing on the reefs, SVG having 1,500 full-time and 1,000 part-time fishers
- Another threat comes from coastal development (hotels, marinas, etc.) putting 75% of the nation's reefs at some risk.
- A third threat comes from boating activity, especially in the Grenadines, leading to damage from boat anchors, fishing gear, and boat-caused pollution.
- A lesser threat, but still a threat as numbers increase, comes from popular recreational activities such as snorkeling, fishing, SCUBA diving, with tourists keen to see wildlife in what has been described as the 'critter capital of the Caribbean.'
- Damage to the reefs from storms that are becoming more regular and more violent with climate change.
- Another climate-change-induced threat is the decline in coral's carbon calcification ability (i.e., the ability of coral to form a limestone skeleton) because of ocean acidification, which is predicted to affect 10% of all SVG corals by 2040.
- Thermal stress (i.e., the seawater becoming too warm for corals because of climate change) is predicted as likely to be enough to cause bleaching every year in SVG from about 2040.

Strand 7: Marine Environment

Unit 7: Mangroves and Coral Reefs

Topic 3: Mangrove and Coral Reef Advocacy and Action

Activity 21: Restoring the Mangroves; Protecting the Coral Reefs

Purpose: Having students consider various initiatives on St Vincent and the Grenadines aimed at mangrove swamp and coral reef restoration

Time needed: 65 minutes

Resources needed

- Photocopy per student of October 2018 *Searchlight* article, 'Over 280 mangrove trees planted at Canash Beach and Great Bay Head' or for those with home Internet access, give web link: <https://searchlight.vc/searchlight/news/2018/10/02/over-280-mangrove-trees-planted-at-canash-beach-and-great-head-bay/>
- Photocopy per student of June 2019 US Embassy news item, 'Ashton Lagoon Restored after 24 Years of Severe Degradation' or for those with home Internet access, give web link: <https://bb.usembassy.gov/ashton-lagoon-restored-after-24-years-of-severe-degradation/>
- Have available Internet access so the class can watch all or some of the video *The Coral Gardeners of Petit St Vincent*.
<https://www.youtube.com/watch?v=iis-FSy5XB0> (14:39 minutes)

Procedure

Pre-lesson: Half the students read the 2018 *Searchlight* article and half the students read the 2019 US Embassy news item. For the two items, see *Resources* above. (Homework)

Step 1: Have students work quietly by themselves and think of the *three* things that impress them in their reading they would most like to share with their fellow students. (5 minutes)

Step 2: Have the students form a sitting circle with two breaks in the circle to cut off by a small space for those who read one article from those who read the other. Hence, each half of the class forms its complete semi-circle. Then, invite those who read the *Searchlight* article to describe in broad outline what the article says and, second, to share the three things that most impressed them in the article and that they would like to share. From time to time, invite those in the other semi-circle to put their questions and give their opinions. (10 minutes)

Step 3: Repeat the process with those who read the US Embassy news piece presenting. (10 minutes)

Step 4: Have the class identify things they find in common in the two mangrove restoration accounts. (10 minutes)

Step 5: Invite the class to view the video on coral restoration, *The Coral Gardeners of Petit St Vincent*. As they watch, have students write down things they see and hear that particularly impress them. (15 minutes)

Step 6: Ask students to share their initial impressions from the film and then broaden the discussion to try and identify factors that link the mangrove restoration examples to the coral reef restoration example, as well as things that make them differ. (15 minutes)

Extensions

1. Invite a representative of Sustainability Grenadines (SusGren) to class to talk about its work on the Ashton Lagoon Restoration Project and its general mangrove restoration efforts. Have the class prepare in advance key questions they would like to put. Where necessary, use another environmental group for this activity. Email address for SusGren: susgreninc@gmail.com
2. Explore possibilities for class members to become involved in mangrove restoration/replanting/monitoring efforts

Potential/Facilitation Tips

This lesson draws together the strands left untied from the previous two lessons, in which environmental threats, effects and actions were considered by moving on to practical restoration projects going forward on SVG. It gives students the chance to weigh the pros and cons of such projects and, first, implicitly, and then explicitly opens the way to ask: would you like to get involved? (See *Extension 2*)

Curriculum Links

This activity connects with the 'Social Responsibility' theme in Form 2 Social Sciences, where the achievement indicators include 'Examine the social problems in any given environment' and 'Discuss strategies to resolve/reduce these problems.' It also links with the 'Civic Ideals and Practice' achievement indicator, 'Demonstrate good citizenship through various activities.' It also links with the English curriculum in its call for students to 'make oral summaries of media excerpts.'

Strand 8: Land Environment
Unit 8: Land Degradation
Topic 1: Coastal Erosion: Causes and Effects

Activity 22: Causes and Effects of Beach Erosion

Purpose: Exploring primary causes and effects of beach erosion; exploring actions to combat coastal erosion

Time needed: 65 minutes plus a varying amount of preparation time at home

Resources needed

- A cut-up set of coastal erosion cause cards, a cut-up set of coastal erosion action cards and a few blank cards per group of four or five students
- A sheet of chart paper, colour markers and blu tack per group

Procedure

Step 1: A couple of days before the lesson, ask students to talk to their parents or grandparents about: (1) beach erosion on local beaches they have noticed over the years; They can also speak to others in the community if their family members do not have the relevant experience to share. (2) Any consequences they have noted due to beach erosion; (3) any actions that have been taken to address beach erosion. Ask them to take some notes and, if possible, bring some old pictures taken before the beach erosion happened. (A varying amount of time at home)

Step 2: Have students form groups of four or five. Distribute a sheet of chart paper colour markers and glue stick. Have each group divide the chart paper into four sections and write down the headings as indicated in *Box 17*. Ask each group to share beach erosion examples (including photos) they have gathered, write down the examples and stick the photos in the first column. After a few minutes, invite groups to briefly share some examples and then draw upon the information in *Box 18* as appropriate. (10 minutes)

Box 17

Beach Erosion: Examples	Beach Erosion: Causes	Beach Erosion: Impacts	Beach Erosion: Actions

Box 18

- Mayreau is confronted with the real possibility that the sea will split the island into two, destroying its world famous Salt Whistle Bay, a great visitor attraction.
- Beach erosion in Brighton is getting extremely serious. A beautiful sand dune has been lost
- Over the past several decades, Georgetown's shoreline has been suffering from significant erosion
- Honor Bay beach in Mustique was washed away during the hurricane, leaving only rocks

Sources: UNESCO: Sandwatch Manual; Chance, K. The Caribbean Island of Mayreau Could Be Split in Two Thanks to Erosion.

<http://www.ipsnews.net/2018/11/caribbean-island-mayreau-split-two-thanks-erosion/>;

Experts fear taking sand from beach will cause massive erosion.

<https://searchlight.vc/searchlight/front-page/2017/05/12/experts-fear-taking-sand-from-beach-will-cause-massive-erosion/>; Georgetown Coastal Defence, St. Vincent.

<http://www.smithwarner.com/portfolio-item/georgetown-coastal-defence-st-vincent/>; UNESCO et al. 2003. *Wise Practice for Coping with Beach Erosion. St Vincent and the Grenadines*

Step 3: Give each group a cut-up set of beach erosion cause cards together with a few blank cards. Ask each group to read the cards carefully and write down additional causes for beach erosion on the blank cards. Have them place the cause cards in the second column, grouping them as they see fit. Inform them to discuss links between a specific erosion example and specific cause(s). If they notice any links, they should use the first colour marker to draw in arrows and explanatory notes along with the arrows. Invite groups to share what they have discussed briefly. To add more information, draw upon *Box 19* as appropriate. (10 minutes)

Box 19

- Beaches are continuously changing – from day to day, month to month and year to year – as the natural forces of wind and water meet the land. These changes, which have been taking place for millions of years, are linked to variations in wind, waves, currents and sea levels
- Humans have a big role to play in this process as well, through mining stones, gravel and sand from the beaches, polluting and damaging coral reefs, and constructing buildings and walls too close to the sea

Source: UNESCO et al. 2003. *Wise Practice for Coping with Beach Erosion. St Vincent and the Grenadines*

Step 4: Ask each group to discuss and write down impacts of beach erosion in the third column. Encourage them to consider social, cultural, environmental and economic impacts. Also encourage them to write down direct personal impact examples if any. Have them discuss links between specific cause(s) and specific impact(s). Using the second colour marker, draw in arrows and write explanatory notes along the arrows. (10 minutes)

Step 5: Give each group a cut-up set of coastal erosion action cards and blank cards. Ask each group to read the cards and write additional action ideas on the blank cards sticking them in the fourth column. Using the third colour marker, draw arrows between items in the action column and the causes and/or impacts columns, writing explanatory notes along the arrows. (10 minutes)

Step 6: Have groups hang their charts on the classroom wall and invite everyone to examine each other's work, groups at all times leaving a 'host' available to explain their work to 'visitors'. (10 minutes).

Step 7: Hold a whole-class discussion focusing on humans' role in beach erosion. (15 minutes)

Extension

Have students individually or in small groups investigate what the Physical Planning Department and/or local groups (e.g., the Bequia Community High School, which monitors local beaches) have been doing to slow down beach erosion. Hold an additional class session for the presentation and discussion of findings.

Potential/Facilitation Tips

As changes in beaches often take place gradually and slowly, students might not be aware of how local beaches have changed over the years. Discussion and information gathering at home (*Step 1*) will help students raise their awareness of beach erosion issues. You should be ready to share your observations on beach erosion (and some photos if you have them) during the activity.

While beach erosion occurs as part of a natural process, it is important for students to understand that human activities have dramatically increased the speed and severity of beach erosion.

To facilitate this activity, read *Case Study 14: Coastal Features, Projects and Threats* in the *Resource Manual*.

Curriculum Links

This activity complements the 'weather and erosion' topic of the National Systems (Physical) section of the Form 2 Geography curriculum, which calls on students to 'suggest ways of reducing preventing erosion' It also complements the Life Science strand of the Form 2 Integrated Science and Technology curriculum, which includes the following achievement indicator: 'examine the impact of human activity on the environment.'

Beach Erosion Cause Cards

Hurricanes and tropical storms occurring between June and November	High waves during 'winter' months resulting from storms in the North Atlantic Ocean, and known as swell waves or locally as 'ground-seas'
Climate change-induced sea-level rise taking place slowly over decades	Removing sand and other materials from beaches and dunes for construction purposes
Badly planned sea defenses	Pollution from human activities on the land damaging coral reefs and seagrass beds
Removing vegetation from coastal areas	

Source: UNESCO et al. 2003. *Wise Practice for Coping with Beach Erosion. St Vincent and the Grenadines.*

Beach Erosion Action Cards

Conserve and restores vegetation cover in beach areas with native vegetation (e.g., grasses, vines and salt resistant, deep rooting mangrove trees)	Carefully plan for existing and future coastline development (e.g., by positioning all new development at a 'safe' distance landward of the vegetation line).
Monitor the rate of coastline change and share the finding with all relevant stakeholders	Stop the mining of sand from beaches and dunes
Create 'hard' engineering structures (e.g., seawalls)	Take beach enhancement measures such as offshore breakwaters and beach nourishment (i.e., placing sand from the offshore zone or an inland source on the beach) at a particular site
Plant trees behind the beach	Conduct beach and underwater clean-ups
Develop education materials, information signs, murals, exhibitions and/or give dramatic presentations to create awareness among the general public	Impress upon tourism developers that a beach is a fragile entity

Source: UNESCO et al. 2003. *Wise Practice for Coping with Beach Erosion. St Vincent and the Grenadines.*

Strand 8: Land Environment
Unit 8: Land Degradation
Topic 2: Soil Erosion: Causes and Effects

Activity 23: Soil Matters

Purpose: Appreciating the importance of healthy soil; exploring primary causes and effects of soil erosion

Time needed: 65 minutes (20 minutes for *Stage 1*; 45 minutes for *Stage 2*)

Resources needed

- A4 paper per student (or student's notebook)
- Two sheets of chart paper and colour markers per groups of four or five

Procedure

Stage 1

Step 1: Ask students working individually and avoiding discussion to complete a sentence beginning 'Without healthy soil, we wouldn't be able to.... because...' on a sheet of paper (or the student's notebook). Once completed, ask students to form groups of four or five and share and discuss each other's sentences. Following the discussion, have them negotiate a mutually agreeable sentence and write it down in large print on their first sheet of chart paper. (10 minutes)

Step 2: In the whole class session, ask each group to share their consensus sentence, taking any questions from the rest of the class. Draw upon the information from *Box 20* at appropriate points in the discussion. (10 minutes)

Box 20

- Soil is a vital part of our environment. Healthy ecosystems depend on healthy soil. Countless species living in soil create a dynamic and complex ecosystem
- Top soil (rich in plant nutrients) in its normal state contains mineral particles formed by weathering of rocks, organic particles (i.e. the decaying remains of plants and animals called *humus*), air, water and living organisms such as earthworms, bacteria, protozoa (single-celled microscopic animals) and fungi
- Soil erosion is the displacement of the top soil
- Soil plays an important role in supporting trees and plants (including food crops) by serving as a storehouse of water and minerals required for their growth
- Soil can purify and decompose substances
- Healthy soil protects underground water supplies by filtering out potential pollutants

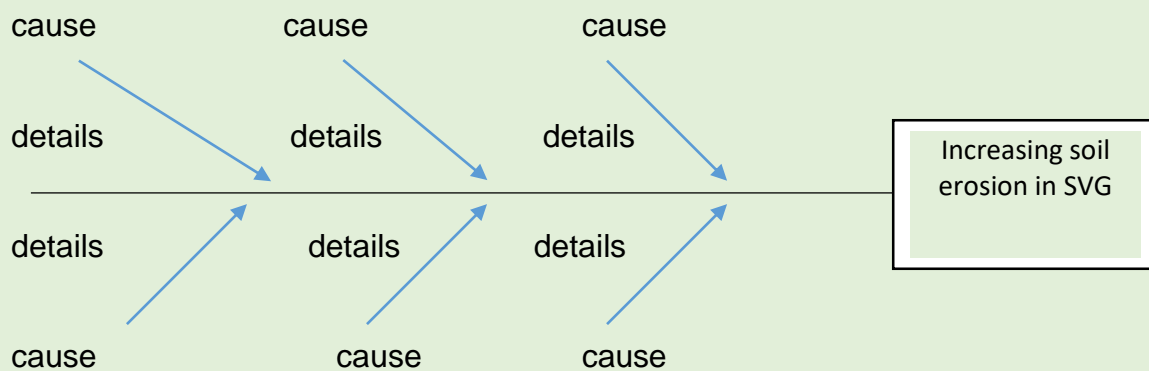
- Healthy soil can absorb huge amounts of greenhouse gas emission
- Soil is a non-renewable natural resource

Sources: SVG Environmental Education Committee. *Environmental Education Resource Booklet for Primary and Secondary Schools*, 132-33; *WWF Soil Erosion and Degradation*

Stage 2

Step 1: Ask students to stay in the same groups formed for *Stage 1 Step 1*. Distribute the second sheet of chart paper and markers. Explain that their task is to brainstorm the leading causes of soil erosion in SVG using the fishbone diagram (see *Box 21*). Draw a large version of the basic diagram on the board. Show that, for instance, they can write 'bushfire' as a cause and write in 'burning of the vegetation layers affect soil conditions and vegetation growth process' and 'making topsoil more susceptible to erosion' as details. Encourage them to come up with at least four causes (bones) and write more if they can. (10 minutes)

Box 21: Fishbone Diagram



Step 2: Once completed, invite each group to share what they have written. Using the large fishbone diagram drawn on the board, compile different causes shared by different groups. After all the presentations, draw upon the information in *Box 22* to fill in gaps in student thinking. (20 minutes)

Box 22: Causes of Soil Erosion

- **Wind:** When strong winds blow, the topsoil along with the organic matter is carried away by the wind. This happens more often when the land is not covered with grass or plants and when the weather is dry.
- **Water:** When it rains heavily in the hilly areas, the soil gets washed away. The running water deposits the mineral rich topsoil in the riverbed. This happens more often when the land is not covered with grass or plants.
- **Deforestation:** Cutting down of trees on a large scale for agricultural purposes, houses, fuel wood, charcoal and lumber leaves an open and

exposed landscape. When large areas of the forest are cleared, the top soil gets eroded by wind and flowing water

- **Overgrazing:** Grazing animals regularly eating grasses and shrubs in the same areas of pasture or grasslands leads to the removal of the plant cover. All the available grass including the roots are eaten. This makes the top soil vulnerable to wind and flowing water.
- **Use of Agrochemicals:** Pesticide and other agricultural chemicals change soil composition and disrupt the balance of microorganisms in the soil. This stimulates the growth of harmful bacteria at the expenses of beneficial kinds that help promote soil health.
- **'Slash and Burn' Farming:** 'Slash and burn' farming where trees and bush are cut down and burnt to provide ground for crops and livestock to grow (the ash making the soil fertile) leads to soil deterioration after a few years. Then another area of forest is slashed and burnt.
- **Over Cropping:** When the land is being continuously under cultivation and is not allowed to lie fallow between crops, the ability of farmland to produce humus for soil fertility is reduced. With less humus the soil dries out and is more open for wind and rain erosion.
- **Bushfires:** Bushfires partially or completely burn the vegetation layers and affect soil conditions and vegetation growth processes. Bush fires make the top soil vulnerable and more susceptible to erosion.

Sources: <http://lcgeography.preswex.ie/how-human-activities-can-accelerate-soil-erosion.html>;
<https://www.worldwildlife.org/threats/soil-erosion-and-degradation>

Step 3: As a whole class, discuss the impacts of soil erosion. At appropriate points, draw upon the information in *Box 23* to fill in gaps in student thinking. (10 minutes)

Box 23: Effects of Soil Erosion

- **Food Insecurity:** Removal of topsoil (the most productive and nutrient rich part of the soil) results in lower agricultural yields and higher production costs
- **Water Pollution:** Soil eroded from the land, along with pesticides and fertilizers applied to fields, washes into streams and waterways. This pollution can damage freshwater and marine habitats and impact on the local communities that depends on them.
- **Increased Flood Risk:** Converted land (e.g. from a forest to a crop field or pasture) is less able to soak up water, making flooding more common. Also, sediments that accumulate down slope of the erosion can obstruct the flow of water in streams and drainage canals, leading to flooding
- **Increased Drought Risk:** When the organic matter that exists within the topsoil is removed, soil's ability to hold water is weakened leaving the field susceptible to droughts
- **Increased Carbon Emissions:** Soil erosion depletes the amount of carbon the soil is able to store. When the soil's organic matter is reduced or destroyed in response to changes in land cover and land use, some carbon

in the soil is converted into carbon dioxide and so is lost from the soil. Some 60 percent of carbon stored in soils and vegetation has been lost as a result of land use changes since the 19th century.

Sources: <http://lcgeography.preswex.ie/how-human-activities-can-accelerate-soil-erosion.html>;
<https://www.worldwildlife.org/threats/soil-erosion-and-degradation>;
<https://www.reuters.com/article/us-unep-soil/soil-erosion-increasing-global-warming-threat-unep-idUSTRE81C13J20120213>

Step 4: Have each group look at the statement they have written in *Stage 1 Step 2*. As a summary of the lesson, invite a few volunteering students to re-phrase the statement by elaborating it based on the new learning taking place during the lesson. (10 minutes)

Potential/Facilitation Tips

Each stage of this activity starts by exploring students' existing knowledge concerning soil. Do not give inputs before they explore the topic using their pre-existing knowledge.

A fishbone diagram is a helpful tool in brainstorming the root causes of a problem and sorting out ideas. Encourage students to keep asking *Why* the soil erosion in SVG is increasing. Soil erosion is a slow and natural process that continues unnoticed, but it is now happening rapidly due to unsustainable land use by human beings. It is vital to identify human-made causes to develop effective actions to slow down soil erosion.

Revising the statement created in *Stage 1 Step 2* ('without healthy soil, we wouldn't be able to.... because...') at the end of the lesson will help students synthesize their learning.

Curriculum Links

This activity complements the 'weather and erosion' topic of the National Systems (Physical) section of the Form 2 Geography curriculum, which calls on students to 'suggest ways of reducing preventing erosion'. It also complements the Life Science strand of the Form 2 Integrated Science and Technology curriculum, which includes the following achievement indicator: 'examine the impact of human activity on the environment'.

Strand 8: Land Environment
Unit 8: Land Degradation
Topic 3: Environmentally Friendly Agriculture Practice

Activity 24: Organic Farm Fieldwork

Purpose: Exploring sustainable farming practices as a contribution to addressing soil erosion and promoting soil conservation; allowing students to observe and engage with organic farming practice

Time needed: 40 minutes in class followed by a whole day or half-day field experience followed by further class and out-of-class time to prepare a work display

Resources needed

- A copy of the *Sustainable Agriculture in the Richmond Vale Academy* handout per pair
- For each student on the field visit: writing pad and paper, pens and pencils, sketch pad
- Available for groups or individuals to use on the field visit: audio recording facility, cameras

Procedure

Stage 1: Preparation for the Field Trip

Step 1: Identify a local organic farm for the field trip. It might be one of the following locations. (see *Box 24*) but you should explore other options in your locality.

Box 24: Field Visit Locations

- Richmond Vale Academy (RVA) is located on 30 acres of farmland in the leeward coast of St Vincent. It provides on-farm education courses. <https://richmondvale.org/en/>
- Spring Organic Farm is a 200-acre valley of largely untouched forest, situated in the windward side of St Vincent. <https://www.springfarmstvincent.com>

When the field trip has been arranged, parental consent and support in facilitating the trip are secured; hold a pre-trip class session to explain the purpose and details of the trip (preferably with the adults present). Note the materials and equipment students are to bring, and the other materials and equipment will be made available for students to draw upon (see *Resources needed* section). (10 minutes)

Step 2: Ask students to form pairs. Give each pair a copy of the case study handout. Ask them to read it carefully and write down questions they would like to ask organic farmers during the field visit. Give some space for class discussion on what has been read and questions developed (30 minutes)

Stage 2: The Field Trip

Step 1: Arriving at the location begin with a pre-arranged introduction for the students given by a farmer (10 minutes)

Step 2: Have a pre-arranged guided tour of the farm with the farmer. (Varying amount of tour time)

Step 3: End the visit with a pre-arranged session with a farmer, at which students can pose their questions, follow up on things they have not understood and share their thoughts and feelings.

Stage 3: Back at School

Step 1: Allot class and homework time to develop a display of their field visit work. This can include samples of writing and artwork and a photo display. (If your school has a school garden, encourage students to come up with practical ideas so that they can apply what they have learned at the organic farm to the school's gardening practice.

Step 2: Set up the display in a well-frequented school area and have students host it and respond to other students' questions.

Potential/Facilitation Tips

Prepare for the field visit in good time, ensuring permission from the principal and school authorities, and consent for the visit from parents or guardians, and agreement from some parents and community members to help with it. Arrange for the involvement of farmer(s) in good time, so they are ready and able to meet the students and give a guided tour of the farm.

Prepare the students, too, by coming up with concrete questions they would like to ask. While the class may not necessarily visit the Richmond Vale Academy (RVA), examining the RVA case study will give students concrete ideas about organic and sustainable farming practices. Student questions can be directly linked to soil erosion and soil conservation, but encourage them to come up with other, more wide-reaching questions.

In preparation for facilitating this activity, read *Case Study 20: Climate-Smart Agriculture* in the *Resource Manual*.

Curriculum Links

This activity complements the 'weather and erosion' topic of the National Systems (Physical) section of the Form 2 Geography curriculum, which calls on students to 'suggest ways of reducing preventing erosion' It also complements the Life Science strand of the Form 2 Integrated Science and Technology curriculum, which includes the following achievement indicator: 'examine the impact of human activity on the environment.'

Handout: Sustainable Agriculture at the Richmond Vale Academy (RVA)

- *Organic production and diversification:* From 2012 to 2016, the use of chemicals at RVA was gradually stopped. A variety of herbs and flowers (e.g., rosemary, thyme, chives, aloe, marigolds) are planted along the borders of the vegetable beds to deter pests. Non-fossil fuel-based bio repellents (e.g., cayenne, garlic) are applied to plants with a spray can. Some crops are introduced as pest repellents, while other crops are cultivated to assist in nitrogen fixation in the soil. Livestock graze in specific and strategic areas to assist with weed removal, allowing for the spread of manure as organic fertilizer to revitalize and maintain the pH balance of the soil.
- *Integrated farming:* A system of continuous intercropping is used, mixing up different plant families within each bed. These are planted in a guild system by which species of plants are grouped to provide mutual benefits to the group as a whole. Benefits of guild planting include protecting species from potential pest problems and improving nitrogen levels in the soil.
- *Renewable energy:* RVA has introduced an off-grid-photovoltaic solar panel system to become energy self-sufficient and to remain operational, especially in the event of a central system electricity failure due to climate change events or other hazards and to reduce the Academy's fossil fuel footprint.
- *Erosion control:* New swales (i.e., shallow trenches dug along the land's contour line horizontally) have been constructed in the areas prone to erosion damage. The swale slows run-off water while recharging groundwater and providing extra nutrients and water for trees and other productive and support species planted along the swale.
- *Water harvesting, recycling and management:* RVA has a rainwater harvesting system that collects rainwater from the roofs of the Academy and stores it in a 150,000-liter capacity pool. Four gravity-fed mega tanks have been constructed to reuse water from showers, washing machines, and sinks at RVA. Recycled water is channeled to irrigate specific crops.
- *Agroforestry:* Trees have been incorporated into the farming system to help sequester (i.e., capture) carbon and other nutrients, such as nitrogen, and to improve soil health. The orchard is being converted into a thriving food forest by increasing diversification in layers and enhancing productivity. An organic banana patch on half an acre, where gliricidia trees existed, has been established. The gliricidia branches are periodically cut and dropped to enhance the soil around the



Organic banana patch with gliricidia trees (Richmond Vale Academy)

bananas. The plan is to add vanilla and cacao trees and other support species, so biodiversity in the field is increased.

- *Mulching and composting*: Dry leaves and other organic matter (gliricidia leaves and vetiver grass) are left to decompose on agricultural beds and help to increase soil fertility and composition. This, combined with other practices, optimizes nutrient flow through the production system. This helps ensure that the crops cultivated can grow and be nurtured without chemicals, while the continuous enrichment of the humus layers creates a buffer against harsh climatic conditions. Erosion from heavy rainfall is avoided, and soil moisture is maintained during dry conditions.

RVA's efforts have helped farmers increase awareness and knowledge of sustainable and climate-smart agricultural practices, which leads them to enhance their productivity and increase their income while protecting and conserving their environment.

References

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CARIBSAVE Partnership. (2012). *CARIBSAVE Climate Change Risk Profile for St. Vincent and the Grenadine*.
https://www.researchgate.net/profile/Mark_New/publication/272791668_Climate_Change_Risk_Profile_for_Saint_Vincent_and_the_Grenadines/links/55fa74f708ae07629e007648/Climate-Change-Risk-Profile-for-Saint-Vincent-and-the-Grenadines.pdf

Richmond Vale Academy. <https://richmondvale.org/en/>

Richmond Value Academy. (u.d.). *Climate Smart Agriculture in St. Vincent and the Grenadines: A Brain-Stormed Organic Approach to Agriculture*. <http://repiica.iica.int/docs/B4154i/B4154i.pdf>

Activity 25: Wildlife under Threat

Purpose: Understanding key concepts linked to wildlife endangerment; developing appreciation and empathy for wildlife and particularly for the endangered and endemic species of SVG; deepening understanding of the range of factors leading to wildlife loss.

Time needed: 60 minutes giving longer class time preparations for *Step 4* if possible

Resources needed

- A set of the same *Endangered Species Search Card* for each group of five/six students so that each group is working with a different card
- Making available materials – cardboard, markers, glue sticks, scissors, string etc. – for post-class mask making

Procedure

Step 1: Remind students of their work on biodiversity towards the close of the last school year and have them rehearse what they recall about why diversity is important and what is behind biodiversity loss. (10 minutes)

Step 2: Explain to the class that in the following two lessons they will learn about the endangered species of SVG. Trigger a discussion about key terms, asking students to explain what they understand by the terms. Reinforce the students' understanding of the terms by drawing on the information given in *Box 25* below. (20 minutes)

Box 25

Wildlife Protection: Key Terms

Wildlife refers to any living organism that is not domesticated (i.e. bred and managed for and by humans) and which lives in its own natural *habitat* (i.e. its own natural environment). Wildlife covers **fauna** (animals) or **flora** (plants) but is more commonly used with reference to animals.

An **Endemic Species** is an animal or plant that occurs naturally in one geographic area. Some species are only to be found in one region (i.e. they are *regionally endemic*). There are species restricted to the Caribbean region. Some species are only to be found on one island, which is the case with the endemic species of St Vincent and the Grenadines.

An **Endangered Species** is an animal or plant that is at serious risk of becoming *extinct* (i.e. dying out) and is unlikely to survive unless the factors causing its decline are lessened in their effect or removed.

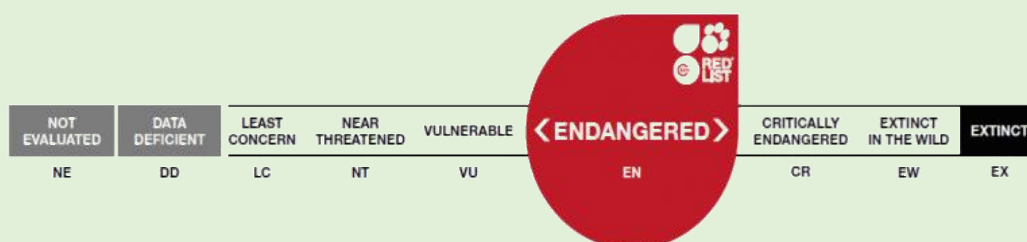
A **Protected Species** is an animal or plant that it is forbidden in national law to harm or destroy. Protected animal species cannot be hunted or their habitat destroyed; protected plants cannot be plucked or dug up. Breaking the law leaves the offender liable to prosecution. A **Partially Protected Species** is an animal that can only be hunted in a designated hunting period (its *open season*) but must otherwise be left alone (i.e. during its *closed season*).

Step 3: Go on to introduce the IUCN, the International Union for the Conservation of Nature and explain the categories it uses to assess the threat to each species (see *Box 26* below). Draw the spectrum of categories on the board and explain to the students that the SVG species they are going to study are all located around the *Endangered* point on the spectrum. (10 minutes)

Box 26

International Union for the Conservation of Nature [IUCN]

IUCN is an international non-governmental organization that has become the global authority on conserving the natural world. Established in France in 1948, it has devoted itself to the protection of species and habitats. In 1964 IUCN established its *Red List of Threatened Species* that has become the most comprehensive source of information on species at risk of extinction. Currently there are more than 105,700 species on the *Red List* with 28,000 species threatened with extinction. The *Red List* is based upon placing species according to a spectrum of positions from species of *Least Concern* (meaning their health and numbers are in good shape) to species that are *Near Threatened* to species that are *Vulnerable* to species that are *Endangered* to species that are *Critically Endangered* to species that are *Extinct in the Wild* (although some may remain in zoos) to species that are *Extinct* (meaning none exist anywhere). See the spectrum diagram below.



Source: https://www.iucn.org/resources/conservation-tools/iucn-red-list-threatened-species#RL_categories

Step 4: Ask the class to form a circle and number off 1-6 round the circle. Then have all 1's join together, all 2's join together and so on. When the groups are assembled, hand out a different set of cards to each. Explain that all groups are to prepare themselves to participate in a *Council of Endangered Species* to be held during an upcoming class. Explain, too, that this is no ordinary research task but one in which

groups prepare to allow their allotted species to speak *through* them. At the Council they should attempt to see the world through the eyes of that species and enter its experience of the world. Their card gives them leads on where to look for information, but what they will read is written through the eyes of an outside human observer. Their task is to 'get inside' the creature they represent in speaking at the Council. In Council, they will in a first speech be asked to speak of their physical nature and way of life and in a second speech of what they contribute to the web of life, how life has changed for them because of the conditions created by humans and the part they could play in restoring biodiversity. Give groups the rest of the session to plan their research and preparations. The latter should include (1) group members making their imaginative masks to represent their creature (2) group members rehearsing speaking through the mask as the creature in question always using the 'I' form. (20 or more minutes)

Extension

Devote an additional class to preparations for the Council.

Potential/Facilitation Tips

This class sets the scene for the next class when the *Council of Endangered Species* first familiarizes students with key concepts and focuses them on the letter and spirit of their representational task. Initially, students may feel inhibited or embarrassed about the task presented to them. Help them settle to the task by stressing the importance of seeing the world differently and through different eyes. Show how they might approach the task. Stress, too, that what they will do would prove very enjoyable after some initial embarrassment! Their preparations outside school emphasize the importance of talking with older folk in the community (who may remember times when species were more plentiful) and approaching the organizations listed on their cards.

In preparation for facilitating this activity, read *Case Study 15: Biodiversity Loss and Conservation on SVG* in the *Resource Manual*.

Curriculum Links

This activity complements the 'Organisms and Environment' theme of the Form 2 Integrated Science and Technology Life Science curriculum strand where there is a learning outcome on the interaction of biotic and abiotic elements in the environment and an achievement indicator calling on students to be able to 'examine the impact of human activity on the environment.' It also fits with the IST Earth Science strand, where students are introduced to the notion of an ecosystem, interrelationships within an ecosystem and the impacts of climate change upon those relationships. The mask-making can be undertaken under the 'Creating, Interpreting and Presenting' Visual Arts curriculum for Form 2 where students are enjoined to draw on other areas of the curriculum for art and design purposes. Drama curriculum time might also be used for helping students prepare for the *Council of Endangered Species*.

Source: This and the next activity are broadly based on the *Council of All Beings* workshop

process described in John Seed et al. 1988. *Thinking Like a Mountain: Towards a Council of All Beings*, Heretic Books/New Society Publishers, pp.97-115.

Endangered Species Search Cards

The St. Vincent Whistling Frog

There are two types of Whistling Frog on SVG. The *Common Whistling Frog* is found near towns while the *St. Vincent Whistling Frog* lives in countryside and wild places. It can be distinguished from the *Common Whistling Frog* by the red colours on the inside of its back legs. It is sensitive to pollution. Reducing the forests of SVG is threatening its survival. Search hints:

- The St Vincent Whistling Frog is *endemic* to SVG and IUCN *red-listed*
- Google St Vincent Whistling Frog to see what you find!
- Revisit the short SVG National Parks, Rivers and Beaches Authority threatened species video as shown in class:
<http://nationalparks.gov.vc/nationalparks/index.php/news-and-events/89-threatened-species-video>
- Check out the Convention on Biological Diversity web pages on St Vincent:
<https://www.cbd.int/countries/profile/default.shtml?country=vc>
- Check out the YouTube video on Whistling Frogs:
<https://www.youtube.com/watch?v=u5quYQ4JH6c>
- Check out the article and pictures from the latest field assessment of the St Vincent Whistling Frog:
https://www.researchgate.net/publication/320777038_Recent_Field_Assessment_for_the_St_Vincent_Frog_Pristimantis_shrevei
- Look at the Whistling Frog eggs:
<https://www.sciencephoto.com/media/377819/view/eggs-of-the-whistling-frog>
- Ask people about their encounters with the Whistling Frog!
- Make your Whistling Frog masks!

The Union Island Gecko

The *Union Island Gecko* is a tiny, beautiful lizard with jewel-like markings. The only known population of this rare gecko is to be found on a patch of forest on Union Island. There are an estimated 10,00 individuals but numbers are declining fast because of poaching for the illegal pet trade. Search hints:

- The Union Island Gecko is *endemic* to SVG and IUCN *red-listed*
- Google Union Island Gecko to see what you find!
- Visit the Fauna & Flora International website on the Union Island Gecko. Link: <https://www.fauna-flora.org/projects/union-island-gecko-initiative>
- Contact Union Islanders for their thoughts on the Gecko; ask about the sound it makes
- Ask the SVG Forestry Department about why the Gecko is important
- Collect some pictures of the Gecko
- Find out about the Gecko and the international pet trade: <https://www.msn.com/en-gb/news/offbeat/this-shy-caribbean-lizard-is-now-a-coveted-pet—and-critically-endangered-how-did-this-happen/ar-AAAJwbb?li=AAAnZ9Ug>
- Find out about Fauna & Flora's successful efforts to add the Gecko to Appendix 1 of the Convention on International trade in Endangered Species means: <https://phys.org/news/2019-08-rare-caribbean-gecko-highest-cites.html>
- Read what the organization Edge of Extinction has to say about the Union Island Gecko: <http://www.edgeofexistence.org/species/union-island-gecko/>
- Make Gecko masks!

The St. Vincent Parrot

The *St. Vincent Parrot* is the national bird of SVG and is seen as a symbol of the country's unique natural heritage. It is the only parrot found on SVG.

Search hints:

- The St. Vincent Parrot is *endemic* to SVG and IUCN *red-listed*
- Google St. Vincent Parrot to see what you find!
- Visit the Birdlife International website on the St Vincent Parrot. Links:
<http://datazone.birdlife.org/species/factsheet/22686403>
<http://datazone.birdlife.org/species/factsheet/22686403>
- Revisit the short SVG National Parks, Rivers and Beaches Authority threatened species video as shown in class:
<http://nationalparks.gov.vc/nationalparks/index.php/news-and-events/89-threatened-species-video>
- Arrange a visit to the Kingstown Botanical gardens to observe and enquire about the St Vincent Parrot conservation program. Or watch a video on the Garden's conservation program:
<https://www.youtube.com/watch?v=ZQRZhdID8AI>
- Read what Beauty of Birds of Birds has to say about the St. Vincent Parrot: <https://www.beautyofbirds.com/saintvincentamazonparrots.html>
- Meet captive parrots on YouTube:
<https://www.youtube.com/watch?v=2pSsDwX3mmc>
<https://www.youtube.com/watch?v=LMZYuRxJuns>
- Ask people about their encounters with the St. Vincent Parrot!
- Make your St. Vincent Parrot masks!

The Whistling Warbler

The *Whistling Warbler* is found in undisturbed areas of mountain forest and can most easily be seen at the Colonaire and Perseverance Valleys and at Richmond Park. It has become a rare sight because deforestation is taking away its home. Search hints:

- The Whistling Warbler is *endemic* to SVG and IUCN *red-listed*
- Google St. Vincent Whistling Warbler to see what you find!
- Revisit the short SVG National Parks, Rivers and Beaches Authority threatened species video as shown in class:
<http://nationalparks.gov.vc/nationalparks/index.php/news-and-events/89-threatened-species-video>
- Learn about the Whistling Warbler from the ebird website, look at the photos and listen to it: <https://ebird.org/species/whiwar1/VC> Also browse the Internet IBC Bird Collection of information and photos: <https://www.hbw.com/ibc/species/whistling-warbler-catharopeza-bishopi>
- Ask people about their encounters with the Whistling Warbler
- Make your Whistling Warbler masks!

The Black Snake

The *Black Snake* lives mainly in forest areas where it hunts early in the morning for frogs, lizards and small rodents. It can grow to a length of 107cm (3ft). Although lots of people dislike snakes they play a valuable role in maintaining the balance of nature, controlling rodents populations. The Black Snake is harmless. Search hints:

- The Black Snake is *endemic* to SVG and IUCN *red-listed*
- Google St. Vincent Black Snake to see what you find!
- Revisit the short SVG National Parks, Rivers and Beaches Authority threatened species video as shown in class:
<http://nationalparks.gov.vc/nationalparks/index.php/news-and-events/89-threatened-species-video>
- Look at the SVG stamp that featured the Black Snake:
https://colnect.com/en/stamps/stamp/425445-St_Vincent_Blacksnake_Chironius_vincenti-Fauna_and_Flora-Saint_Vincent_and_The_Grenadines
- Look at the IUCN webpage on the St. Vincent Black Snake:
<https://www.iucnredlist.org/species/4672/115069815> and the Wikipedia web page:
https://en.wikipedia.org/wiki/Saint_Vincent_blacksnake#Geographic_range
- Ask people about their encounters with the Black Snake!
- Make your Black Snake masks!

Hawksbill Turtle

You can recognize the *Hawksbill Turtle* by its bird-like beak. It uses its beak to dislodge sponges and other soft-bodied sea creatures from the coral reefs. The plates on its shell overlap. It is suffering a worldwide decline in numbers because of the trade in its shell and meat. Most countries ban the trade.
Search hints:

- The Hawksbill Turtle visits SVG but is not SVG endemic; it is IUCN *red listed*
- Google the Hawksbill Turtle to see what you can find!
- For facts on Hawksbill Turtles, visit the WWF website:
<https://www.worldwildlife.org/species/hawksbill-turtle>
- Look at what the website on the Old Hegg Turtle Sanctuary on Bequia says about the Hawksbill Turtle:
<https://dorothyadeletravels.com/endangered-hawksbill-sea-turtle/>
- Watch the video on the Tobago Cays Turtle Sanctuary:
<https://www.youtube.com/watch?v=rk7DLN2umco>
- Browse the document on the conservation status of the Hawksbill Turtle in the Caribbean, describing the many threats to the turtle:
<http://www.iacseaturtle.org/eng-docs/publicaciones/Conservacion-Carey-ing.pdf>
- Learn about the banning of the killing of sea turtles by the SVG Government and the royal visit that followed:
<https://www.svggef.org/grants/the-marine-turtles-conservation-project/>
- Ask people about their special Turtle encounters!
- Make your Turtle masks!

Strand 9: Ecosystem and Biodiversity Threats

Unit 9: SVG Endangered Species

Topic 2: Establishing Concern and Empathy for Endangered Species

Activity 26: Council of Endangered Species

Purpose: Expressing appreciation and empathy for wildlife, particularly for the endangered and endemic species of SVG; deepening understanding of the range of factors leading to wildlife loss.

Time needed: 85 minutes

Resources needed

- An open space with chairs for each group arranged in a circle so that each group sits together but is part of a circle of groups
- Each group should bring their masks and any other props they have decided to use

Procedure

Stage 1

Step 1: Invite groups to sit together in their cluster of chairs. Have the quotation from *Box 27* written on the board or flip chart paper. Read it out two times over. Then ask the class to say what they think it is saying. [Explain that the quotation comes from a tribal chief from the Pacific Northwest of North America, Chief Seattle, and was made to a tribal assembly in 1854. Say that they should disregard the archaic sole use of 'man,' 'men' and 'sons' on that account.] (5 minutes)

Box 27

What is man without the beasts? If all the beasts were gone, men would die from a great loneliness of spirit. For whatever happens to the beasts soon happens to the men. All things are connected. All things are connected like the blood that unites one family. Whatever befalls the earth befalls the sons of earth. Man does not weave the web of life; he is merely a strand in it. Whatever he does to the web, he does to himself. – Chief Seattle

Step 2: Discuss how the *Council of Endangered Species* will operate. Explain that each group will be asked to speak twice. On the first round one group after another will be asked to introduce themselves as the species for which they are the voice. They should describe what they look like, describe their way of life, and express how it feels to be who they are. Remind everyone to wear their masks and only speak in the first person form. Say that other groups, staying in character, can ask questions after each presentation. Emphasize that they should only talk of themselves and their way of life during this first round and not any problems they face. In the second round, groups speak to how their life has been - and is being - changed by what

humans are doing, good or bad. On this round, too, ask groups to speak of what their extinction will mean for their habitat and humans. (5 minutes)

Stage 2

Step 1: Open the first round of the Council using the kind of words set out in *Box 28* below. Then have each group give their first presentation, taking questions afterward. (25 minutes)

Box 28

You creatures are now gifted with the power of speech. Tell us how it feels to be you. What are the strength and qualities you have that particularly delight you? Tell us about your way of life. Try to stay true to who you are and speak only in the first person? Those listening can ask questions of you after you have spoken.

Step 2: Open the second round of the Council using the kind of words set out in *Box 29* below. Then have each group give their second presentation, taking questions afterwards. (25 minutes)

Box 29

Now speak about how your life is being changed by what humans are doing. What is being lost? What is being damaged? How is your life being changed? What do you fear? If you become extinct what will it mean for your habitat? Will your loss somehow hurt humans?

Step 3: Close the Council in two stages. First, have students stay in role and facilitate an exchange between the species on their feelings and experiences. Second, invite students to come out of role and talk about the Council experience. Did they feel empathy for their species? What did they learn about the threats species face? Are they now thinking differently about the species comprising the Council? (15 minutes)

Step 4: End us by drawing attention back to the Chief Seattle quotation with which the session began. Ask what links the class discerns between the learning from the Council and what Chief Seattle is saying. (10 minutes)

Potential/Facilitation Tips

The key to the facilitation of this activity is that of helping students negotiate the initial sense of strangeness provoked by speaking as another creature. Try to help the class to see this as an unexceptional process. Once it is underway, initial nervousness will be replaced by a lot of fun and laughter and delight and wonder at what is said. The masks will be a source of joy and admiration! In facilitating the

closing discussions, attempt to draw out the range of threats to species that emerge from the presentations and elicit the connection made by Chief Seattle and, probably, implicitly or explicitly by each presentation, species loss is also our loss.

In preparation for facilitating this activity, read *Case Study 15: Biodiversity Loss and Conservation on SVG* in the *Resource Manual*.

Curriculum Links

This activity complements the 'Organisms and Environment' theme of the Form 2 Integrated Science and Technology Life Science curriculum strand where there is a learning outcome on the interaction of biotic and abiotic elements in the environment and an achievement indicator calling on students to be able to 'examine the impact of human activity on the environment.' It also fits with the IST Earth Science strand, where students are introduced to the notion of an ecosystem, interrelationships within an ecosystem, and the impacts of climate change upon those relationships. The mask-making can be undertaken under the 'Creating, Interpreting and Presenting' Visual Arts curriculum for Form 2 where students are enjoined to draw on other areas of the curriculum for art and design purposes. Drama curriculum time might also be used for helping students prepare for the *Council of Endangered Species*.

Source: This and the previous activity are broadly based on the *Council of All Beings* workshop process described in John Seed et al. 1988. *Thinking Like a Mountain: Towards a Council of All Beings*, Heretic Books/New Society Publishers, pp.97-115.

Strand 9: Ecosystem and Biodiversity Threats
Unit 9: SVG Endangered Species
Topic 3: Conservation Protection Measures

Activity 27: Layers of Conservation

Purpose: Considering the range of organizations, measures and mechanisms, local to national to global, aiming at wildlife protection and how they are interconnecting or might interconnect to a synergistic effect.

Time needed: 105 minutes (65 minutes for *Stage 1* and 40 minutes for *Stage 2*)

Resources needed

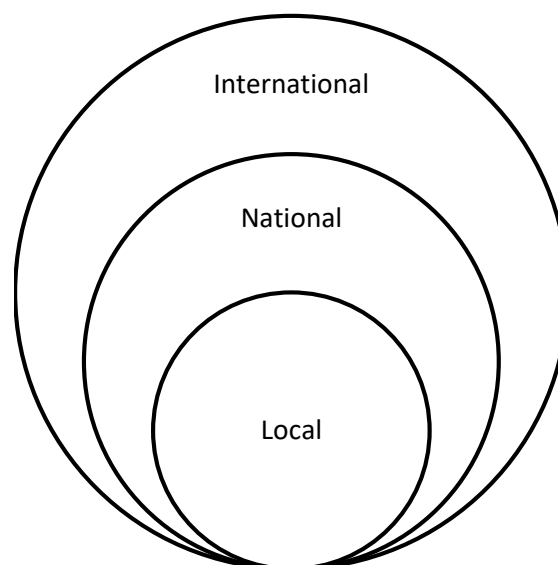
- A large chart for each group of four students
- Glue stick and two different coloured markers for each group
- A cut-up set of *Wildlife Conservation Cards* for each group

Procedure

Stage 1 (first lesson)

Step 1: Have students form into groups of four and hand out the chart paper, glue sticks, markers and card sets. Explain that their task is to organize the cards by drawing three concentric circles on their chart as per the diagram in *Box 30*. (5 minutes)

Box 30



Step 2: Have groups carefully consider each Wildlife Conservation Card, discussing where to place it on their chart. Explain that some cards might fit in more than one area, in which case they can be stuck along the borderline between two areas or placed in one area with arrows drawn to other areas. (10 minutes)

Step 3: Continue the group work by exploring *links* and *synergies* between the organizations, measures, and mechanisms featured in the cards. [Explain that *synergy* is an interaction or cooperation between two or more things to produce a combined effect greater than each on their own could produce. In this case the combined effect is better wildlife conservation.] Links and synergies they find should be represented by two-way arrows using one color marker with a brief

note of explanation added to the chart. Links and synergies that, from the cards, do not appear to be exploited can be drawn/written in using the marker of a second colour (15 minutes)

Step 4: Invite each group to report back, encouraging discussion of the links and synergies they have detected and, equally important, where they find no or insufficient links or synergies. (25 minutes)

Step 5: End by asking the class what they have learned from the activity. Arrange for pairs within groups agree to research further into the subject of a particular *Wildlife Conservation Card* and to the next class ready to give a two-minute briefing on what they have learnt. Encourage them to ask about or otherwise find out about their chosen subject's level of cooperation with other organizations, measures and mechanisms and if they think that works to good effect. (10 minutes)

Stage 2 (second lesson)

Step 1: Have pairs report back on their research and, after each report, encourage ideas on how well those working for conservation are cooperating. (30 minutes)

Step 2: Have each pair make a short concluding statement on 'The Conservation Scene on SVG.' (10 minutes)

Potential/Facilitation Tips

Looking at international conventions and national legislation can be tedious, quickly waning attention. This activity attempts to enliven the study by asking students to place different conservation organizations, measures, mechanisms and initiatives within a frame and then look at inter-linkages and synergies. A big message coming out of the activity is that conservation is at its most effective if different organizations, measures, mechanisms and initiatives, local through global, are linked together. A question that needs to be asked out of the activity is: does more need to be done by SVG - and more joined-up efforts (synergies) put in place - to ensure more effective conservation, taking into account the dire threats wildlife faces? The out-of-class research between *Stage 1* and *Stage 2* offers a purposeful way of reinforcing student knowledge of national legislation and international organizations and initiatives.

In preparation for facilitating this activity, read *Case Study 15: Biodiversity Loss and Conservation on SVG* in the *Resource Manual*.

Curriculum Links

This activity complements the 'Organisms and Environment' theme of the Form 2 Integrated Science and Technology Life Science curriculum strand where there is a learning outcome on the interaction of biotic and abiotic elements in the environment, and an achievement indicator calling on students to be able to 'examine the impact of human activity on the environment.' It also fits with the IST Earth Science strand, where students are introduced to the notion of an ecosystem, interrelationships within an ecosystem, and the impacts of climate change upon those relationships.

Wildlife Conservation Cards

<p>CITES</p> <p>The <i>Convention on International Trade in Endangered Species of Wild Fauna and Flora</i> (CITES) is an international agreement between 183 governments (including SVG) that polices the international trade in wild animals and plants, so protecting more than 35,000 plants and animal species from the danger of extinction.</p>	<p>NBSAP</p> <p>Since 2000 SVG has had a <i>National Biodiversity and Action Plan [NBSAP]</i> to guide the implementation of the International Convention on Biological Diversity to which SVG is a party. NBSAP is concerned with integrating biodiversity protection into national planning, management of resources, land use and preservation of natural habitats.</p>
<p>Wildlife Protection Act</p> <p>The SVG Wildlife Protection Act of 1987, revised 1990, protects endangered species such as the St Vincent Parrot, the Black Snake, and the Union Island Gecko while also partially protecting other, less endangered species, save for during a restricted hunting period. Schedules linked to the Act add new species to the protected list from time to time. The Act also controls the wildlife trade into and from SVG (imports and exports).</p>	<p>Fauna and Flora International</p> <p>Fauna and Flora International (FFI) was the world's first conservation organization (started in 1903). In 2015 at the invitation of the SVG Forestry Department, FFI began a project to save the threatened Union Island Gecko by protecting the richly bio-diverse forest in which it lives and by stopping the illegal trade in the Gecko to reptile collectors in Europe, Japan and North America. It has campaigned, successfully, to have the Gecko CITES-listed</p>
<p>National Parks, Rivers and Beaches Authority</p> <p>The National Parks, Rivers and Beaches Authority aims to preserve ecosystems in SVG. Guided by the 2002 <i>National Parks Act</i> and the <i>National Parks and Protected Areas System Plan, 2010-2014</i>, it oversees 34 protected areas (3 forest reserves, 24 wildlife reserves and 7 marine conservation areas, such as Tobago Cays Marine Park and Reserve). It runs the Sea Turtle Conservation Program monitoring the two main beaches where turtles come ashore and combatting negative human impacts of sea turtle populations.</p>	<p>Convention on Biological Diversity</p> <p>The United Nations Convention on Biological Diversity (CBD) has as its main goal the development of national strategies for the conservation and sustainable use of biological diversity. SVG signed the CBD treaty in 1992 and its aims inform the work of SVG conservation and biodiversity authorities. SVG's fifth national report to CBD in 2015 looked at the biodiversity status of the country as well as threats to SVG biodiversity. The report covers all areas of SVG conservation.</p>

<p>Sanctuaries</p> <p>On SVG, there are well-known sanctuaries, such as the Tobago Cays Turtle Sanctuary and the Old Hegg Turtle Sanctuary, trying to increase the number of endangered Hawksbill and Green Turtles and threatened Leatherback Turtles, and then release them back into the wild. They often rely on volunteer help and community support. The Botanic Gardens in Kingstown maintains a captive breeding program for the endangered St Vincent Parrot.</p>	<p>Collective Citizenship Action</p> <p>The biodiversity of Ashton Lagoon on Union Island was destroyed by a marina development that went bankrupt. A partnership of non-governmental organizations, government ministries and, vitally, the local community have restored and brought back to life the species-rich mangrove swamps and coral reefs.</p>
<p>Nature Reserve</p> <p>The St. Vincent Parrot Reserve is one of the wildlife reserves of the SVG National Parks, Rivers and Beaches Authority. Within the Reserve is the Vermont Nature Trail that goes through lush rainforest and offers every likelihood that the visitor will see the St Vincent Parrot in its natural habitat. The Reserve is awash with plants, birdlife and other fauna.</p>	<p>Forestry Protection</p> <p>The SVG government's <i>Forest Resource Conservation Act</i> of 1992 provides for the conservation of forests and the establishment of Forest Reserves. The Reserves are for conserving plants and animals with negative actions such as tree/vegetation removal and destruction, land and stream pollution, land clearance, and prohibited charcoal production.</p>
<p>IUCN</p> <p>The International Union for the Conservation of Nature is a global alliance of 1300 organizations and governments (including SVG). It maintains its famous <i>Red List</i>, started in 1964, that lists and publicizes the conservation status of fauna and flora. There are 28,338 species on the <i>List</i> under threat of extinction (the number continues to rise). The endangered species of SVG are on the <i>Red List</i> and so protected by government and government authorities.</p>	<p>Marine Conservation</p> <p>The <i>Fisheries Act</i> of 1986 specifies conservation measures to protect marine fauna and flora, such as prohibiting the killing of fish by stunning them, restrictions on types of fishing gear, establishing 'close' (no fishing) seasons and, importantly, setting up no-fishing Marine Reserves or Marine Conservation Areas. In 2011 the Grenadines Network of Marine Protected Areas was set up. It began with three protected areas, but the number has dramatically increased as the government specifies more areas/habitats for protection.</p>

Strand 10: Water and Solid Waste
Unit 10: Solid Waste Management
Topic 1: Methods of Waste Reduction

Activity 28: What a Waste?

Purpose: Analysing environmentally friendly, effective and practical methods of waste reduction.

Time needed: 80 minutes

Resources Needed

- Bags of rubbish from the classroom, school or local bins, one per group of 4 or 5
- Gloves, or bags that can be used to cover hands, in sorting through rubbish
- Pens, paper, arts and maths materials
- Metre ruler or tape measure
- Newspaper and/or cleaning products

Procedure

Step 1: Have students work in groups of four or five. Give each group a bag of rubbish from the classroom, school, or local bins. Discuss the different ways that the waste could be categorized. This might include: what it is made from; whether it is made from renewable or non-renewable materials; what can be done with it; why it was generated (i.e. packaging or leftovers or broken) and other categories the class comes may generate. (10 minutes)

Step 2: Ask each group to choose a different criterion for categorization. If there are not enough different categories, some groups may have to adopt the same category, but the class should explore as many other categorization methods as possible. Ask groups to spread out the newspapers, find a suitable space outside, and use gloves to protect the workspace and ensure good hygiene. Ask each group to present their findings helpfully. This might include using bar charts, pie charts, a poster, or a model made with the waste itself. (20 minutes).

Step 3: Ask each group to present what they found out from their waste categorization and analysis, demonstrating and explaining their charts. (10 minutes)

Step 4: Ask students to discuss where rubbish has been binned is usually taken. Using the *Central Water and Sewerage Authority* statistics in *Box 30*, ask students to locate the landfill sites on a map of SVG, discussing which is closest to the school. As a class, using the tape measure or metre ruler, discuss how a cubic metre of rubbish looks. Ask each group to look at their bag of rubbish and estimate its volume, calculating how many multiples of their bags of rubbish would make up one cubic metre. Have the class; use the statistics in *Box 31* to discuss the quantity of waste collected in their nearest landfill site in 2015. Ask each group to calculate how

many multiples of their bag of rubbish this equates to, based on their estimated volume of the bag. As a class, ask students to share any thoughts, feelings or questions that arise for them in considering these statistics. (10 minutes)

Box 31: Waste Volume Statistics in 2015

Disposal Site	Location	Total Volume of Waste(m ³)
Diamond Landfill	St. Vincent	124,120
Belle Isle Landfill	St. Vincent	16,223
Raintree Landfill	Bequia	6,470
Taffia Landfill	Canouan	17,853
Clifton Landfill	Union Island	1,972

Source: CWSA. <http://www.cwsasvg.com/index.html>

Step 5: Ask the class to brainstorm how the waste considered could be reduced and write ideas floated on a flip chart sheet, black or whiteboard. Write up the 8 Rs of Waste Management (see *Box 32* below) on the board. As a class, discuss what these “R”s mean. Then ask each group to discuss and rewrite the 8 Rs, ranking them according to which has the most environmental benefits down to which has the least. Ask the groups to share their ordering with the whole class and engage the class in a discussion where there are differences. (10 minutes)

Box 32: 8 Rs of Waste Management

1. Recycle
2. Refuse
3. Reduce
4. Reuse
5. Repair
6. Re-gift
7. Recover
8. Rot

Step 6: Ask each group to re-rank the 8 Rs again, this time ranking them according to which they would find easiest to carry through down to that which they would find most difficult to carry through. It may help to think about the main ‘type’ of rubbish they found in their bags in *Steps 1* and *2*. Have the group discuss more effective waste reduction challenges and how some of those challenges might be overcome. (10 minutes)

Step 7: Ask the group to debrief on their thoughts and learning from the activity. (10 minutes)

Extension

Have the class monitor the amount of waste collected in a bin in the classroom or school over some time. The bin content could be analyzed at regular intervals, categorized in different ways and data collected.

Variation

For *Step 5*, write up the 8 Rs of Waste Management on the board or piece of flip chart paper. Working in their groups from *Step 1*, have students go through the rubbish from their bags and decide what the 'best' option from the 8 Rs would be for each piece - taking into account environmental benefits and what is plausible in their own lives and community.

Potential/Facilitation Tips

The activity encourages students to reflect on waste generation and different ways to reduce waste. Asking students to think about the challenges they face in reducing waste and how these challenges might be overcome will help them contribute to generating more effective local solutions.

For health and safety reasons, it will be necessary to ensure that no unhygienic waste is included in the distributed bags of rubbish. If waste has had to be removed for this activity, discuss this necessity with students, considering the health risks posed by certain types of waste.

In preparation for facilitating this activity, reread *Case Study 23, Central Water and Sewerage Authority*, in the *Resource Manual*.

Curriculum Links

This activity falls under the Form 2 Integrated Science and Technology curriculum, particularly the theme of 'Earth's Resources' under which the achievement indicators include 'Explain how natural resources are used/processed for man's benefit'.

Strand 10: Water and Solid Waste
Unit 10: Solid Waste Management
Topic 2: Beach Cleaning and Waste Analysis

Activity 29: Trash Tales

Purpose: Analysing the causes of waste on beaches and exploring ‘upstream’ solutions

Time needed: 45 minutes

Resources Needed

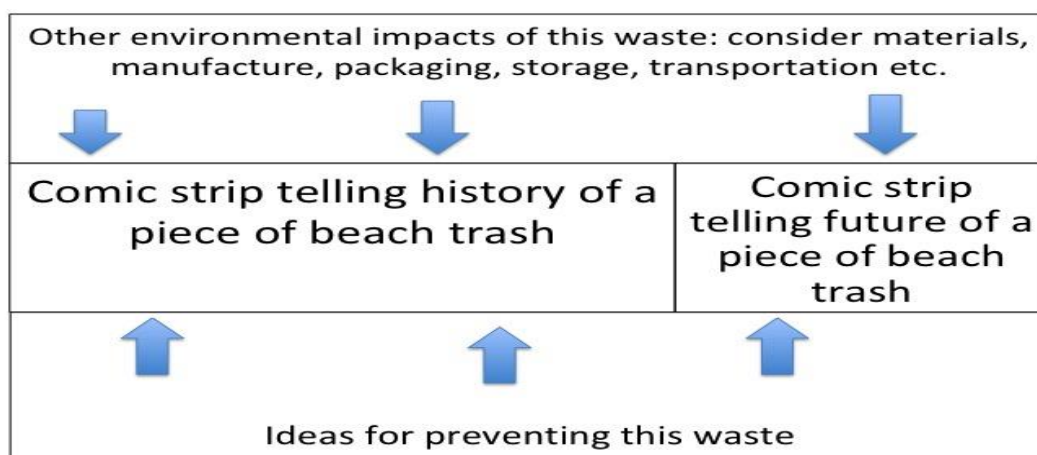
- Paper and art materials
- A piece of waste, one per student, collected from a beach or coastal area

Procedure

Step 1: Ask students to collect a piece of waste from the beach or coastal area near them. If this cannot be done, ask students to think of a piece of waste they have seen on the beach. (5 minutes)

Step 2: Working individually, ask students to take a long strip of paper, for example, three pieces of A4 paper positioned landscape, and stuck side by side. See the *Trash Tales Template* in *Box 33*. Using the central strip of this long page going from left to two-thirds across, ask students to draw the life story of this piece of waste as a comic strip. This should start with its original manufacturing to its being found on the beach. They may need to discuss the origins of the materials with others or (using a phone or computer) look up information on them. From where do they think the materials come? How were they processed into their current form? How did they end up on the beach? (10 minutes)

Box 33: Trash Tales Paper Strip Template



Step 3: Ask students to imagine what could happen to the piece of waste and to draw as a comic strip the future story of the piece of waste had they not found it. Use the central right-hand third of the paper strip for this activity. (10 minutes)

Step 4: Have students think of actions that could have been taken to prevent this trash being on the beach. Looking over the life story of the waste, what actions could have been taken along the way and at what points, each of which might have prevented the beach trash. Ask students to note these underneath the comic strip. (10 minutes)

Step 5: Looking over their waste stories, what other environmental impacts have the piece of waste witnessed; for example, how was it grown or made, manufactured, transported and stored? What materials, resources, energy and pollution, did it entail. Working individually, have each student note these above the comic strip on their paper strip. (10 minutes)

Extensions

Have each student present their comic strip, prevention measures and additional side effects to the class. Invite students to give feedback on each other's work, offering further ideas, questions or reflections that arise for them. As a class, brainstorm the prevention methods noted on the trash tales and write these on flipchart paper, a black or whiteboard, creating a list of actions that would help clean up beaches.

As a class, look at the *No Littering Ad* and the *Illegal Dumping Ad* on the youtube page of the CWSA website <https://www.youtube.com/user/TheSVGCWSA/videos>. Discuss the central message of these adverts and how effective they think the advert is in communicating its message. What makes the advert effective? What could make it more effective? Divide students into groups of three or four. Ask them to choose a beach clean-up action from the list created and to dramatise an advert promoting this waste prevention method. Have students perform their adverts.

Have the students display their 'trash tales' at the school or near the beach.

Variation

Have students work in groups of four or five and read each other's trash tales. Have students compare the different futures of the pieces of trash. Have students discuss these and decide which future was the most preferential and which was the most realistic. Have each group share their findings with the class.

Potential/Facilitation Tips

This activity encourages students to think about problems 'upstream' and where the problem is experienced locally. In analysing the history of a piece of litter, students are also encouraged to think about the many materials, processes and places involved in simple everyday objects. Encourage students to use the resources they have, like phones, a school computer and each other, to look up information relating to their piece of trash. Students can be facilitated in thinking about the consequences

and possible 'downstream' solutions to litter by writing and comparing potential futures for pieces of rubbish.

In preparation for facilitating this activity, reread *Case Study 23, Central Water and Sewerage Authority* in the *Resource Manual*.

Curriculum Links

This activity falls under Form 2 Integrated Science and Technology, particularly the theme of 'Earth's Resources' under which the achievement indicators include 'Explain how natural resources are used/processed for man's benefit.' It also compliments Form 2 Social Sciences: in particular, the theme of 'Social Responsibility' under which the achievement indicators include 'Examine the causes of social problems in any given environment' and 'Discuss strategies to resolve/reduce these problems.'

Strand 10: Water and Solid Waste
Unit 10: Solid Waste Management
Topic 3: Towards Zero Waste Home Action Plans

Activity 30: Action Planning for Home Waste Reduction

Purpose: Reflecting on home waste and planning for its reduction.

Time needed: 35 minutes

Resources Needed

- A cut-up set of *Action for Home Waste Reduction* cards (see handout) for each group of four students with some blank cards per set
- Board copy or paper copies of *Home Waste Reflection Questions* (Box 34)

Procedure

Step 1: Have students respond to the *Home Waste Reflection Questions* as a written homework assignment.

Box 34: Home Waste Reflection Questions

1. Look at all the waste generated in your home, how would you describe this waste?
2. How much of your home waste is:
 - i. Packaging?
 - ii. Fruit and vegetable peelings?
 - iii. Broken, old or used items?
 - iv. Other types of waste? (name them)
3. What do you do currently with your different types of home waste?
4. What do you do currently to reduce your home waste?
Are there any reasons it is difficult to reduce home waste? If so, what are those reasons?

Step 2: Working in groups of four, have students share their responses comparing similarities and differences in their responses. (10 minutes)

Step 3: In their groups, have students look at the *Examples of Action for Home Waste Reduction* cards. Some of these are personal actions, some local community actions and some national actions. Ask students to decide which actions they currently take or believe are actively in place in their area by reflecting on their own experience and knowledge and by looking at the CWSA website www.cwsasvg.com, including the gallery section. Then have students brainstorm other ideas they have that would help - or other actions that are being taken or that they currently take - to reduce home waste, writing these on the blank cards. Half the groups rank these ideas on a continuum from *most effective* for waste reduction to *least effective* for

waste reduction. Have the other half rank these from *easiest to implement* to *hardest to implement*. Have groups share and compare their rankings, mainly focusing on issues drawn out by the different criteria for ranking used. (15 minutes)

Step 4: Have students write their plans for waste reduction in their homes, setting out actions they can take. (10 minutes)

Extension

Have students sketch map their area marking locations connected to waste and waste reduction, including recycling stations, bins, landfill sites, areas where litter collects, libraries and any other location that students feel is relevant. Where possible, visit and reflect on these landmarks. Ask students to think about the following: How could the landmarks be improved? Who is responsible for the landmarks? Who uses or contributes to the landmark? How does the landmark impact local people and the natural environment?; What opportunities are there for improving waste management?

Variation

Have students build a composting system and make eco-bricks. Create a compost pit on the school grounds and put a system for collecting school compostable waste that can be added to the pit. Appoint student and teacher compost monitors to oversee the composting. Use the compost for planting in school. For more information on school composting, go to: www.gardenorganic.org.uk/files/resources/fflp/composting.pdf. Eco-bricks are reusable building blocks made by packing clean and dry used plastic into a plastic bottle to a set density. They can be used to create all kinds of furniture and structures.

For information on eco-bricks, go to <https://www.ecobricks.org/how/>.

Potential/Facilitation Tips

This activity should support student reflections on their waste production. As part of their homework, encourage them to look in their bins (taking appropriate hygiene safety precautions), talk to others in their family and think about everyday waste and things they dispose of less often.

Step 3 provides a framework for encouraging students to think about what actions are most effective, what could be easily implemented, and what challenges to effective waste reduction. In facilitating the discussion, ask one of the groups with the easiness of implementation criteria to identify which actions they felt were easiest to implement and give reasons for their ranking. Ask one of the groups with the degree of effectiveness criteria to explain how effective they felt each of these actions was and give reasons for their conclusions. Invite students who disagree with the rankings presented to share their opinions. Ask another group with the degree of effectiveness criteria to share the actions they felt to be most effective and then consider how easily these actions could be implemented. Encourage students to think about what prevents them from implementing waste reduction measures.

Often the most effective actions are at a community or national level. Encourage students to discuss what helps and what hinders or obstructs these actions from being taken. Are there any actions the students can take, individually or as a class, to support effective waste reduction?

In preparation for facilitating this activity, reread *Case Study 23, Central Water and Sewerage Authority* in the *Resource Manual*.

Curriculum Links

This activity falls under Form 2 Social Sciences: in particular, the theme of 'Civic Ideals and Practice' under which the achievement indicators include 'Demonstrate good citizenship practices through various activities.' It also complements the Form 2 Social Sciences theme of 'Social Responsibility' under which the achievement indicators include 'Examine the causes of social problems in any given environment' and 'Discuss strategies to resolve/reduce these problems.'

Action for Home Waste Reduction Cards

<p>You compost your fruit and vegetable waste at home.</p>	<p>You choose to buy local food instead of imported food as this comes with less or no packaging.</p>
<p>The government places a tax on plastic bags so that people have to pay for them in the shop if they don't bring their own.</p>	<p>The government fines those who dump their waste.</p>
<p>You keep your packaging to use in art classes at school.</p>	<p>Compost bins are made available in school and in the community to bring their fruit and vegetable remains.</p>
<p>Classes are run to teach people how to mend technology, household objects, and clothing to not need to be thrown away.</p>	<p>The school or community centre sets up a swap table, supporting people in passing on and exchanging clothes, books and other objects they no longer need.</p>
<p>You bring your containers to the shops to buy food and drink so that plastic bottles and packaging are not needed.</p>	<p>You recycle your cans and bottles.</p>
<p>The government bans the use of single-use plastic drink bottles.</p>	<p>Your school bans the use of single-use plastic.</p>
<p>You make plastic eco-bricks by packing clean and dry used plastic into a plastic bottle to a set density. You use these eco-bricks to make a sculpture on the school grounds.</p>	<p>The government sets up recycling centres that can recycle glass, cans, paper, plastic and electronic items.</p>