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Students' Response to Global Changes

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Most of the students for whom I am preparing this curriculum unit have immigrated from Puerto Rico, Mexico, and the Dominican Republic. As such, they have had some experience with tropical storms, have seen strong rains, water overflow, erosion, and earthquakes. They wonder why these things occur. I am delighted to be able to teach them about these natural phenomena and global changes. My interest in writing this curriculum unit is to bring the students inside of something very important to humans, animals, plants, etc. I want to engage them in natural occurrences on our planet by immersing them in a study of natural phenomena.

Presenting such complex phenomena to my particular students will prove challenging. These middle school students have been labeled as Educational Mentally Retarded (EMR) or Socially Maladjusted (SMA). They have no independent reading and writing skills, and their reading levels range from pre- to grades 1-8. Most have a very short attention span, hyperactivity, a low frustration tolerance, and very low or no interest in academics. Because of their low comprehension skills and short attention spans, I decided to cover a wide range of topics, to spend only a short time on each of the natural phenomena, and to use a wide variety of visual materials. Instruction will proceed in a simple, clear, visual, and concrete manner. Activities will allow the students to recount the vivid experiences that they faced while they lived in another place.

This curriculum unit will cover four weeks. In the first week, we will discuss the sun, the earth, earthquakes, and volcanoes. The second week concerns mountain valleys, deforestation, and erosion. In the third and fourth weeks, the subjects are rivers, oceans, the coastline, water floods, and storms.

First Week: The Sun, the Earth, Earthquakes, and Volcanoes

Materials:

-films about the sun, the earth, earthquakes, and volcanoes

-science books

-globe

-bulb light with electric cord

-illustrated posters of the solar system and other related pictures

Words to study:

crust	floating	magnet
spinning	rotate	surface
melted	magma	layer
outer	inner	core

Whenever I start teaching about the solar system, my students ask me questions like these: If the earth is moving, why don't we move, too? Are the sun and planets just hanging there? Can they fall and splash us on Earth? Why do the stars appear so tiny in the sky? How come the water on Earth does not spill off the planet? and so on. In order for me to answer questions such as these presented by my students, who are slow learners, I need to use simply written and amply illustrated, colorful books as well as other visual materials, for these aids help facilitate comprehension. From young readers' books of science I have found easy explanations that help me to answer their questions.

Showing a chart of the solar system, the teacher will say: "Think of the sun hanging in space like a giant glowing ball. Think of the bright moon and stars all floating through space. And we here on Earth are floating along with them." (1) The teacher here will use the globe, a light bulb, and other round objects to demonstrate the spinning position of the planets. The teacher also could take the students to the science lab so that they may see and touch the equipment.

Having given the students a more clear idea about how the planets rotate in space, the teacher will introduce the topic "Earth". Again in a simple and concrete manner, holding a globe, the teacher will say, "We know that the planet earth is round like a ball; but it is not perfectly round. The crust, the outer part of the Earth, is made of solid rock. The continents and the floor of the ocean are on the surface of this crust. Below them are many miles of solid rock. Beyond the crust, you would come to the mantle; this layer of earth is made of very hot rock. Next you would see the outer core. Scientists believe that the core is made of melted metals such as iron and nickel. At the very end of earth, you would see the inner core. Here the scientists think that the iron and nickel are solid."

Here the teacher will present a picture of the earth's surface, both beneath and on top of it. Ask the students to draw the picture below of the earth's surface in cross section, to label the parts, and to color it. (Figure A).

Question: Why don't we fall off the earth? What holds us down?

We don't fall because we are pulled back by "gravity". Gravity is a very strong force that keeps us from falling, or in this case, from floating in space. Think of how a magnet holds onto things made of iron. Gravity pulls us in the same way that the magnet pulls the iron. Earth's gravity pulls everything that is on or near the earth's surface to that surface. When things are far away from the earth's surface, gravity has less force. That is why things appear to float in space.

Note: Here the teacher could show a film about spaceships. Also, the teacher can do some experiments with pieces of paper and heavier objects, also with magnets.

How magnets on earth are produced:

The teacher explains that the rotating outer core of the earth produces a magnetic field for the earth. Students will draw a picture of the earth in cross section illustrating gravitational force (Figure B).

Question: If the earth moves, why don't we notice the motion?

The teacher will start by saying: Imagine you are outdoors in the morning. It is still dark. Soon you see the sun

begin to rise. Then we have daytime. Later that afternoon, you are outdoors when the sun begins to set. Slowly the sky grows dark; then it is nighttime again. Here the teacher asks: Is it really true that the sun comes and goes, rises and sets? To demonstrate the answer to this question, the teacher holds a globe and a bulb light, which is plugged into an outlet. The teacher moves the globe around on its own axis and says: the sun does not move; it is earth's movement that gives us daytime and nighttime. The earth rotates or spins all the time. As the earth rotates, only half of it faces the sun. When this happens, it is daytime on the light side. The other part of the earth that is unlighted is nighttime. This is the reason that nights are cooler, because at night we do not have the heat from the sun.

The teacher, still holding the globe, explains that the earth moves in another way as well. While it rotates, it also moves around the sun. Earth takes 365 days to make a complete trip around the sun. We call this a year. In the time between January 1 and December 31, the earth travels once around the sun. Here the teacher will present a film about the earth's rotation if one is available.

Questions:
-Why do we have night and day?

-How many hours does it take the earth to rotate or spin completely?

-How many hours do we have during a day?

-How long does it take the earth to complete its trip around the sun?

Earthquakes:

Throughout history, human beings have dealt with death and destruction caused by natural phenomena. Each year, thousands of earthquakes occur. Of these, about 6000 are strong enough to be felt by humans, and 800 are strong enough to cause damage to buildings. At least twenty are big enough to destroy a major city.

Using a map, the teacher will point to the following places. In Mexico City 7200 people were killed in a 1985 earthquake. In San Salvador, more than 400 people lost their lives. The worst earthquake in the United States occurred in 1906 in San Francisco, when more than 300 people died.

The teacher will say: Picture yourself shopping in a supermarket. Suddenly the building begins to sway. Apples and oranges roll out of their bins, cans and jars tumble from the shelves. You ask: What's going on? It is an earthquake.

Whenever possible, the teacher calls on the class to share their experiences with the natural phenomena under discussion. One way to draw the students into such discussion is to talk about one's own experiences, as with the following:

I was seven years old, living in the countryside in the Dominican Republic. It was about 1:00 one afternoon. I was in the backyard with a woman who worked in my house looking for some vegetables and herbs when I heard a strange sound and felt something wrong. The ground was moving, and the cows were moving. The woman took my arm and ran inside the kitchen. I remember seeing big pans moving on top of the oven and finally falling, pouring all the food around. Later, in the grocery store that my father had, I saw all the cans and bottles falling and breaking into pieces on the floor. My parents and other adults were around me talking nervously and praying; they told me this was an earthquake. The tremors continued for three days off and on. I remember seeing many things that you do not see in a city during an earthquake because we did not have

tall buildings and concrete houses as you do in the city. But I saw the animals, cows, horses, dogs, etc. falling on their knees. I saw big trees falling apart, the big river in front of my house changing its course, the ground opening and animals disappearing into holes in the ground. We leaned in the space of three or four days that anytime that we heard a very strange and deep sound, the earth was going to move again.

The teacher may show a film about earthquakes. The teacher says to the students: “I know that many of you or your relatives have seen a storm; but have you seen an earthquake? How old were you? Can you tell what you remember?” The teacher will allow the students to talk freely.

What causes an earthquake? The earth’s crust is made of rocks. Every day some of these rocks shift or break below the earth’s surface. This involvement causes earthquakes. Most earthquakes are too weak for us to feel. Strong earthquakes can destroy buildings, bridges, and highways. We can’t tell exactly where or when an earthquake will happen, but scientists have a good idea of where they are likely to happen. They use very sensitive machines to keep track of every earthquake. These machines are called seismographs. A seismograph can record even very small movements within the earth’s crust. Slipping and breaking rocks in the earth’s crust cause earthquakes. But what causes the rock to slip or break? Scientists say that because of motions of the earth’s mantle, the earth’s outer layers cracked into gigantic pieces called plates. They say that continents and oceans sit on these plates. These huge plates are always moving. When one plate touches another, the two plates scrape past or press against each other for a long period of time. Eventually, pressure builds up and the pressure causes the rock to suddenly slip or break, and this causes earthquakes.

How can humans avoid the damage that earthquakes cause? To avoid terrible destruction from future earthquakes, people have been asked to build their houses with earthquake resistant materials and according to designs drawn up by engineers who have studied how earthquakes operate.

In what ways do humans respond to disasters caused by earthquakes? Some of the local, national and international agencies that respond to disasters include UNICEF (United Nations International Children’s Emergency Fund), the Red Cross, and local public and private agencies. These people arrive on site to distribute food and build shelters, to treat injured victims, or to set up water purification to avoid epidemics. Sometimes other nations respond to an emergency as well.

Volcanoes:

Words to study:

volcano active weak eruption lava
edges collide dormant extinct magma

The teacher will start by saying, “Imagine that you are sleeping. Suddenly you are awakened by a loud roar. You rush to a window and look out. Huge flames and great clouds of smoke and ash are rising into the air. Something hot and thick is oozing out over the ground. You are watching the eruption of a volcano.”

What causes volcanoes? We learned before that underneath the earth’s surface there are melted rocks. These rocks melt because of the heat produced by radioactivity in the Earth. The melted rock is called magma. Magma also contains gases. When the magma erupts at the surface, it forms lava flows. The hot lava spills out and flows over the land. Volcanoes also erupt explosively, spewing ash over the countryside. These explosive volcanoes are very dangerous. Winds may carry the ash far away before it falls to the ground. Eventually the lava cools and hardens into solid rock. Once a volcano starts, it may go on erupting for a long time. Or it may stop erupting and then erupt again many years later. When volcanoes erupt again and again, they build up

layers of lava over long periods of time, and the layers of hardened lava become mountains. The lava that comes out of the volcano is extremely hot, about twelve times hotter than boiling water.

Volcanoes have different shapes. The shape depends on how thick the lava is and how strongly it is forced out of the vent. If there is a lot of gas inside, there will be a huge explosion and melted rock, ash and dust will pile up in a cinder cone shape. Lava that is thin and runny spreads out to make a low dome-shaped volcano.

Volcanoes can be formed and explode under the ocean, too. If they are big enough and erupt a lot of ashes and lava, they can form an island, as happened in Hawaii. The explosion can make a very strong noise. Once there was a volcano under the ocean in Indonesia. When it exploded, the noise was heard as far away as Australia. When volcanoes explode in the ocean, they can kill many people, too. They can destroy ships and kill all the fishes and other animals around.

Do you know that after many years of the eruption, all the ashes and lava that spread on the ground become a rich, fertile soil that can produce plants and vegetables? With this new plant life, new varieties of birds, insects, and other animals can now live in this area. Central Colombia contains an area with soil made rich by volcanic ash. Here high mountains tower above fertile valleys below. Over the centuries the soil on the mountain slopes has become rich in volcanic ash and is ideal for growing coffee and rice. The people who live here have become used to living in the area of disaster.

One of the most famous volcanic eruptions of all time was at Mount Vesuvius in Italy in 79 AD. For several days the mountain spewed forth lava and ash. The eruption wiped out the nearby city of Pompeii, covering it with 200 feet of ash and killing more than 20,000 people.

Here the teacher will present a film about volcanoes.

Questions: After seeing the movie, can you explain what a volcano is? How does a volcano form? Why does a volcano explode? Could a volcano explode in any area? What is the condition in the ground for a volcano to be formed? When the eruption occurs, what substance comes out of the volcano? Is it hot or cold? How hot is it? The teacher asks the students to draw different volcanoes depicting the different stages of eruption and formation.

Second Week: Mountains, Valleys, Deforestation, and Erosion

Objectives:

That the students learn about the following:

the different features of earth

the formation of mountains

the benefits of mountains

the type of life in the mountains

how people can damage mountains and how we can protect them

the difference between mountains and valleys, etc.

Words to study:

scenery	forest	lichen
climb	protect	twigs
contain	terraced	grip
minerals	slopes	conservation
valuable	croplands	erosion
dams	hills	valley
reservoirs	anticlines	agriculture
grazed	fault	fold

The energy from the interior of the earth is also responsible for making mountains. The features of Earth's surface are determined by responses to two energy sources, the interior heat of the planet and the heat from the sun. The energy from the interior of the earth is responsible for making mountains. The heat from the sun is responsible for eroding them. (2) Mountains rise much higher than the other land around them. Mountains are higher than hills, and they usually have steep sides. Their sides and their tops or peaks are often rocky. Mountains can cover huge areas of land; they are found in groups called ranges.

A mountain is measured by how high it is above the ocean or sea level. The highest mountain of all is Mount Everest. The longest range in the world in the Andes in South America. Mountains are formed by very strong movements under the ground. The force of these movements pushes earth and rocks upward. Mountains rise from deserts, plains, forests, and even oceans. All mountains are not alike. Their type depends on how they were formed. We have three types of mountains.

Types of Mountains:

Block mountains: these are formed on fault lines when great slabs of rocks were pushed up between two faults because of movements in the earth's crust. Note: here the teacher will present to the students colorful charts depicting the different types of mountains, one at a time. An example of this type of mountain is Sierra Nevada. (Figure C).

Dome Mountains: A dome mountain is formed when currents in the mantle push up the earth's crust, making a rounded bulge of rocks. (Here the teacher will recall to the students what they learned about the inside of the earth). Again illustrated posters are presented to the students (Figure D). Students will make their own drawings and label them.

3-Fold Mountains: When horizontal rocks are squeezed from the side, they may develop folds. "The earth's crust is wrinkled by the forces associated with plate techtonics. The shapes of a fold mountain fold mountain depend on the strength of the forces pushing the rocks."

Some fold mountains like the Appalachians in North America are rounded because the surface rock has been worn down by wind and rain. Note: the teacher presents to the students charts illustrating fold mountains (Figure E). The teacher will also show films of different kind of mountains if available.

Plants and Animals in the Mountains:

As you go up a mountain, the weather changes. The higher you go, the colder it gets. If you climb very high, you will reach the snow line. There it is so cold that the snow covers the ground even on the hottest days of the summer. Of course, such a severe climate does not support much plant and animal life.

Other factors make it difficult for plants and animals in the mountains. These include:

- High precipitation waterlogs the soil

-There is a large difference in the temperature between night and day

-High winds dry out plant leaves. In addition, the soils are often thin and infertile. they are easily eroded, making it difficult for plants to grow and spread.

Because food is scarce high in the mountains, only a few animals can live in these high places. They are adapted to life in these difficult conditions. Animals such as mountain sheep and goats have special hard sharp hooves that grip the rocks almost like pincers. These animals also have thick coats to keep them warm. They are able to eat the tough plant food that grows in the mountains, including lichen, grasses, and twigs.

People in the Mountains:

Because of the severity of the climate, the shortage of food, and the poor access to the lowlands, few people live in the mountains. Most of the earth's population lives between sea level and an altitude of 1000 meters.

In many countries, mountain people are poorer than the people in the lowlands. They have a poorer diet, are not as well educated, earn less money, and do not have the benefit of modern medicine. Examples of these are the people in Ladakh, India; the people living in the Himalayas; the Sherpas of Nepal; and the Quechua Indians of Peru.

Many people who come to the mountains from the lowlands suffer from breathlessness, dizziness, and sickness. This is because there is much less oxygen available at high altitudes than at lower ones. But people like the Sherpas and the Quechua have adapted to the high altitude: they have slightly larger lungs and hearts than people living in the lowlands. So they can live comfortably at high altitudes.

The primary way of life of mountain people is farming. Although it is hard to farm mountainous areas in cold places, in some tropical mountain lands, farming is quite successful. In fact, it is so successful that tropical mountain farms may produce foods for people living in the lowlands as well.

Resources in the Mountains:

-Mountains in very warm countries have cloud forests and rain forests. These are very important to the global ecology.

-Mountains contain valuable minerals and building stones. Gold, lead, and copper are examples of products mined from the mountains.

-The streams and rivers coming from the mountains provide the resources to build dams and reservoirs, where water may be stored for drinking or for the production of hydroelectric power. These dams and reservoirs are often built in the plains below the mountains.

-In many mountains the most valuable resource is the scenery. The beauty of the mountains together with the opportunity for many kinds of sports attracts large numbers of tourists. Even in remote mountainous areas, the numbers of tourists are increasing. Some come to participate in sports; others come as spectators, to watch the athletes. Still others come just to relax and look at the beautiful scenery. Mountain sports include fishing, hiking, camping, skiing, tobogganing. Along with the sports people and the vacationers have come workers involved in the tourist industry. Among these people are waiters in the large hotels, mountain guides, and ski instructors.

Deforestation and Erosion

The protection of mountain lands has become very important. To preserve these valuable environments for the future, it is important that we understand erosion and deforestation.

When whole forests are cut down, we have deforestation. In mountain lands, trees are very important because they protect the environment against soil erosion. Their roots bind the soil, and their branches reduce the damaging effect of heavy rainstorms. They slow down the speed of water running down and off the mountains. In this way, they help prevent flooding on the lower land.

Erosion is a process that occurs by water, wind, or ice and that involves the removal of material (soil and rocks). When flood waters from rain and melting snow cross deforested areas in the mountains, the water is not retained by a forest cover. The soil is quickly eroded and carried down into the lowlands. The mountains are left bare of any soil. The rivers, choked with sediment, burst their banks, and the waters destroy farmlands and homes. It may take hundreds of years to replace the soil that has washed or blown away.

One reason that erosion occurs in the mountains is through mining. Typically the mountain land is exploited by the miners who quickly dig out the rich minerals from the soil and then move on. Rarely do they do anything to restore the landscape afterwards.

We can help the problem of erosion through the planting of trees. But trees are important for other reasons as well as the prevention of erosion. They add their leaves to the soil and enrich it. They fill the air with oxygen and water vapor. They also provide homes for the many birds, animals, and insects in the environment. When we cut down the trees for firewood and for building, it is important that we replace them at once with new young trees.

Valleys:

Valleys fall between hills and mountains and are areas watered by a river or other small streams, producing a very fertile soil. Because of their placement in relation to the surrounding hills and mountains, we think of valleys as being low areas, but some are in high places. An example of these are rift valleys, which are produced when blocks of the earth’s crust slip down between faults. Valleys are rich in nutrients, enabling farmers to grow many crops successfully. Valleys are also areas that provide pasture land for cattle, horses, and other animals associated with lowland farming. Valleys may also be covered with wild flowers, big gardens, and many kinds of trees and fruits. They are linked to agriculture and prosperity. Most of the people who work in the mountains actually live in the valleys. The flooding of mountain valleys can enhance the scenery and encourage more people to come for recreation.

The teacher will present several videos of mountains, the rain forest, and erosion produced by deforestation.

Questions:

-Would you like to live in the mountains? Why or why not?

-Can you explain how mountains are formed?

-Would you prefer to live in the mountains or the valley? Why?

-Can you name some products form the mountains?

-Name some products from the valley.

-What happens when trees are cut in the mountains?

-How can we avoid this?

Fourth Week: Oceans and Rivers, the Types of Life on the Coastline:

Objectives:

-To inspire students to learn about such important elements for plants, animals, and humans.

-To increase their knowledge about the importance of the oceans and rivers in all physical changes in the environment, such as weather, seasons, etc.

-To see that the students learn about the different living creatures and vegetation under the water

Words to Study:

source fresh water
element balance
mineral hydrosphere
sodium detect
chlorine ripples
iodine tide
metabolism

Water is all around us— in the air, in the ground. It is in milk, vegetables, fruit, and meats. It is in the leaves of the trees, the trunks, and branches. It is even in stone. “Next to air, water is the most essential of requirements. The hydrosphere, the waters of the earth, its oceans, rivers, and lakes, is vital, constituting a unique feature in the solar system and one responsible for physical and climactic phenomena characteristic of the planet. Water moves through the hydraulic system and runs the heat engine of the earth, approximately 97% of it occurring in the oceans. These contain vast natural resources including abundant plant and animal life and they assist in cleansing the atmosphere by becoming the final repository of Earth and land pollutants, of which many are man-made. Unfortunately their ability to do this is diminished because of rising pollution by toxicants such as DDT, nuclear by-products, and oil spills.

“The oceans contain huge quantities of various substances mostly originating from atmospheric, biological activity, river transport after rock weathering, ground water, spreading zones along mid-oceanic ridges and crystal out gassing. The atmosphere and the oceans together cooperate in an energy cycle important in controlling and equalizing the earth’s surface temperature. The interaction of earth and oceans powered by

solar energy provides a reasonably favorable environment for life on Earth."(3)

What is the Ocean?

The great bodies of salt water that cover almost three-fourths of the earth's surface are the oceans. There are five main oceans called: the Atlantic, Pacific, Indian, Arctic, and Antarctic or Southern Oceans. Note: the teacher will display a world map on the blackboard, pointing to these oceans; the teacher will also give the definition of the sea. A sea is any large body of salt water smaller than an ocean; however, a sea may actually be a part of an ocean or connect to an ocean. Examples of seas are The Mediterranean, Red, and Arabian.

Why is the Ocean Salty?

Sea water is a complex solution in which many different elements have been detected: the most abundant are sodium and chlorine. The most common salt in ocean water is the salt that we use at home to cook— hence the salty quality of ocean water. The ocean is the only source of iodine, an element vital to human metabolism. These elements are brought into the ocean from the land by rivers and rain and from the earth's interior by volcanic activity.

Salinity (or saltiness) is reduced in the oceans by the addition of fresh water from melting ice, by river runoff, and by rainfall. But the salt in the ocean is never depleted, or used up. It is always kept in balance. Though the salt is being used, at the same time, the heat from the sun causes the fresh water to evaporate, and this, in turn, increases salinity. So the ocean is always salty.

Waves:

The sea never stops moving, because the air above it is never still. The wind makes ripples and waves on the sea's surface. The wind pushes the water particles, which move round and round. As the wind gets stronger, the waves grow bigger and bigger. the largest waves are called "tsunamis"— a Japanese word that means flowing waves.

Near the coast ,where the water is shallow, the seabed interferes with the movement of the water. Then the tops of the wave break onto the beach.

The Tides:

From minute to minute, and even from second to second, the level of the ocean continually changes. During part of every day, the ocean water becomes deeper. And in the following period every day, it grows shallower. This alternate rise and falling of the water is called the tide. The water moves vertically up and down, producing a high tide and a low tide twice a day.

Life in the Oceans:

David Lambert comments as follows: "The seashore, where land meets sea, is teeming with life. Barnacles, limpets, sea anemones, and seaweeds grip rocky shores so hard that even storm waves cannot wrench them loose. At low tide, shellfish close their shells to keep their moist bodies from drying up. Shore fish are stranded in little pools and crabs squeeze under shady boulders. The shifting surface of a sandy shore offers no such hiding places or firm surfaces to cling to. Yet little more than an inch down, the sand is filled with burrowing animals."(4)

Jacques Costeau describes life in the oceans in the following way: “From the vast expanses of its surface waters to its beaches and marshes and tideland and mangrove swamps, from its many thousands of miles of rocky shores to its deepest and darkest abyss, the sea produces life in fantastic abundance.

“Sea snails and many other animals lie hidden safe from hot summer sunshine, cold winter winds, and battering storm waves. At high tide, the folded seashore comes alive as its inhabitants creep out from their protective shelters to feed. Burrowing creatures push up tubes or feelers to suck in or grab tiny scraps of food brought in by the sea. These small seashore creatures in turn provide a food for hungry seabirds.”(5)

Each layer of the sea is home to living things suited to that level.

Ocean Bird Life:

Of the thousands and thousands of species of birds in the world, fewer than 300 are truly marine in that the sea is their normal habitat and the principal provider of their food. Though divers, grebes, marine ducks and waders spend much of their lives on salt water, they are excluded from this count, as they do not range widely over the oceans.

Seabirds are the most numerous in places where turbulence and upwelling causes the upper layers of the sea to become rich in the nutrients that support an abundant supply of invertebrates and fish.

The broad categories of seabirds can be distinguished according to habitat: those that feed near the coastline or forage on islands, such as pelicans, cormorants, skimmers, and gulls; and those that dive for fish in offshore waters, like penguins and petrels.

All seabirds nest on land, though their choice of site varies widely.

Note: The teacher can use illustrations, films, and even the Internet to explore with the students the variety of seabirds.

Oceans and People:

“To early sailors, oceanic storms and reefs were frequent causes of deadly shipwrecks. Yet people have long dared to make the sea a highway and a source of food. Now sturdy fishing boats range into wild polar waters, engineers pump oil from seabed wells, modern nuclear submarines can circle the world below the surface of the oceans, and underwater explorers in pressure-proofed vessels plunge miles deep.”(6)

As we can see, the ocean has been an excellent resource for humans throughout history. Unfortunately, though, with all the incursion into the ocean, and especially with irresponsibility on the part of some, our oceans are suffering. Many plants and animals have been killed, affecting the source of nutrition for billions of people. Certain governments and groups have misused the ocean, either out of ignorance or out of carelessness or greed. For example, in Kuwait during the Desert Storm War, oil was poured into the ocean. Again, through human carelessness, huge amounts of oil were spilled in Alaska. Also, sometimes, people dump waste into the ocean, because they do not want this waste on the land. The dumping of oil or waste into the oceans creates an alarming risk to ocean life. Certain species may even become extinct as a result of human actions; all will be affected. It is our responsibility as human beings to understand the risks involved to other species and to try to protect them.

Rivers:

Rivers are also very important to plants, animals, and humans. Rivers help living things in many ways; for example, the water that people and animals drink often comes from rivers, and some of the fish that people eat are taken from rivers. Rivers help bring water to the land where plants grow. They turn water wheels, making the machines in mills and factories work. Rivers turn the machines that produce electricity.

Rivers offer humans many recreational opportunities. Some people like to go fishing or boating on rivers, others like to swim in rivers, and almost everyone likes to look at the scenery along a river.

Rivers are natural roads; along these roads, boats and barges carry things from one place to another. Men have sailed along rivers for thousands of years. Because the earliest settlements depended for their livelihood on access to water trade, these settlements often grew up along the shores of rivers. Many settlements along rivers could be reached by the same ships that sailed across the ocean.

Where Do Rivers, Springs, and Streams Come From?

Much of the rain that falls sinks into the earth. This water is called ground water. Some of the water flows out of the ground again. When ground water comes out again, this is called a spring. The spring water flows downhill and joins other springs to make streams. When there is alot of water, the springs become full. When there is no rain, some springs dry out.

Mountain streams are the beginning of rivers. Rivers are born high up in the mountains, from rain and melting snow. The beginning of a river is called the upper river. Gravity makes water flow downhill. As a stream flows downhill, it flows fast. When it comes to flat land, it slows down quickly. So it drops most of its soil and sand all at once. The rocks that cover the beds of mountain streams were carried along and then dropped by the water. As the river flows through its lower valley, it loses more and more of the sand, salt, and minerals. These are dropped along the river bed and finally into the ocean, where the river ends.

Some river valleys have been drowned by the sea. When this happens, sea water flows part way up the river valley, hiding the river valley under sea water. This occurs in rivers like the Mississippi, Hudson, and Connecticut. Here the sea intrudes only a short distance into the rivers, but the tidal effect is felt for a great distance. That is why the Hudson River is tidal, even 150 miles away from the ocean.

How Is a Waterfall Formed?

A stream sometimes passes from harder rocks to softer rock. It wears away the softer rock more quickly. When this wearing away has occurred over a long time, the softer rock underneath the river may become so steep that it forms a cliff. Then the water falls off the cliff to a lower level. This is how the falls of the Niagara River were made.

Flooding:

Just as rivers can be very helpful to humans, so they can also do harm. When rivers flood their banks, they can carry away people’s homes and belongings, causing damage and death. In the springtime heavy rains and/or melted snow fill the river, entering the river from the small streams that feed it from the mountains above. These small rivers or streams that flow into a bigger river are called tributaries. When the rain waters are especially heavy, the big river spills over its banks, killing people and animals, damaging farms, and carrying houses and big trees away. This is called a flood. The flood water picks up soil and sand from the river bottom and spreads some of it over the valley land. The sand and soil have many chemicals in them; these make the

valley more fertile or rich in plant food.

Because farms, towns, and cities have been built in the fertile valleys of large rivers, these valleys need to be made safe from floods. The rivers must be tamed. One way to tame a river is to build levees along its banks. Another way to tame a river is to build a dam across the river. The heavy flow of water is collected in a large lake behind the dam, which is called a reservoir. With the help of the reservoir and the dam, the river does not rise too high.

Keeping Water Clean:

The people who live and work along the rivers do not always use them wisely. Factories sometimes dump their waste into the rivers. And sometimes sewers empty into the rivers. The water of these rivers is no longer pure. It has become polluted. It is not safe to bathe in these rivers or to drink the water. The fish in a polluted river begin to die.

People must learn how to get rid of their waste so that they do not pollute the rivers and oceans. The government has helped with this problem by passing laws that keep big factories from polluting.

Fifth Week: Tornadoes, Thunderstorms, and Hurricanes

Objectives:

1. That the students gain a clear idea of what these natural phenomena are and why they occur.
2. To create some awareness of what to do to protect themselves and their families when these disasters are to come.

Words To Study:

tropical	lightning	sparks	thunder
storms	moisture	meteorologist	weather
temperature	hurricane	whirling	seawall
evacuate	streaks	tornado	disaster
weather balloon	typhoon	forecast	spectacular

What’s the weather like? Everyday, people throughout the world ask this question. It is not surprising that they do, because the weather affects us all. It affects how we dress, how we spend our leisure time, how comfortable we are. One group it affects particularly is farmers. Crops can be destroyed by flooding, which is caused by too much rain, or by drought, which is caused by too little rain.

For many people, the state of the weather can be a matter of life and death. Violent storms at sea can sink ships, lightning can strike a person and kill her, or a sudden snowstorm can cause a skier to be stranded on a mountain top.

But what exactly is weather? We can say that the weather is the conditions that exist in the air around us at any time. This includes the temperature and pressure, and the amount of moisture in the air. Other elements of the weather include: winds, clouds, rain, snow, hail, fog, and frost. We call the science that deals with the

weather meteorology and the scientist who studies the weather, a meteorologist. By studying past and present weather, meteorologists try to predict or forecast what the weather will be like in the future.

The main cause of the weather is the sun. It provides the energy for the weather machine.

The air around us is always moving, making wind. The wind varies in speed and direction from day to day. In winter the wind blows from the cold land out to the warmer sea. In summer the wind blows from the sea on to much hotter land.

Whirlwinds and Tornadoes:

On very hot days in summer, you sometimes see little whirling columns of leaves and dust rise above the dusty ground. These never grow very tall and last only a few seconds or minutes. These are harmless; however, the much larger whirlwinds or rotating windstorms called tornadoes cause tremendous damage. Tornadoes (or twisters) can spring up in many parts of the world, but are most common in the United States. They are among the most destructive winds that occur on the planet, and they arise with little warning.

A tornado is a violent twisting whirlwind that forms at the bottom of a thunder cloud and then spirals its way down to the ground. It is a kind of funnel. If a tornado passes through a town, houses in its path literally explode as the air inside them suddenly expands. As the whirlwind column of the tornado hurtles over the ground at speeds up to 60 m.p.h., the strong upward current of air at its center sucks up or destroys everything in its path. Some tornadoes can lift very heavy objects, like houses or trucks right off the ground.

Tornadoes last from 15 minutes to 5 hours. The word tornado comes from tronada, the Spanish word for thunderstorm.

Thunder and Lightning:

Thunderstorms are the most spectacular of all weather happenings. They are great natural fireworks displays. During thunderstorms brilliant streaks of lightning zigzag between the clouds and down to the earth. Torrential rains and often hail lash down during thunderstorms.

Most thunderstorms happen in summer, when air is warm and damp. As air rises, it cools, and the moisture it contains forms huge grey-black thunderclouds. Thousands of thunderstorms occur every day, especially in the tropics.

Thunder and lightning actually happen at the same time, but because light travels faster than sound, we see lightning before we hear the thunder. Lightning can be very dangerous, because when it strikes, it can start fires, or knock down trees and buildings. Every year, hundreds of people are killed by lightning.

Hurricanes:

A hurricane is a very big storm with winds that whip around in a great circle. Hurricanes are similar to tornadoes, but they differ in a number of ways too. Hurricanes are always accompanied by heavy rains. Hurricanes are much larger and stronger than tornadoes. They may cover thousands of square miles. On a satellite picture, a hurricane looks like a big doughnut or a pinwheel. In the center of a hurricane is a calm part called the eye. Hurricanes may occur in many parts of the world. But in other parts of the world they have different names. They may be called typhoons or tropical cyclones. But by any name, these are always terrifying storms.

It is not known for sure how hurricanes are formed. But the ingredients that go into making a hurricane are the following: ocean water, the heat of the sun, air, wind, and the spin of the earth. Hurricanes always start in the ocean and grow much stronger three days after first starting. After the hurricane is formed, it moves like a spinning top and is carried across the ocean by the wind. When the hurricane comes to the land, it weakens and then gradually disappears. It weakens because as it moves over the land or over cold water surrounded by land, it loses its fuel, which was the warm ocean. Typically, a hurricane leaves much destruction in its path. Like tornadoes, hurricanes can send trees, cars, and pieces of buildings flying through the air. These flying objects are a common cause of the deaths that occur with hurricanes.

One of the biggest killers in hurricanes is water. The wind piles up huge amounts of water along the shoreline. The water rolls across the coast and drowns people. In coastal areas, property damage from hurricanes comes from powerful seawaves, high winds, and driving rains. Hurricanes pose a perpetual threat for people living in coastal areas. Although scientists are studying hurricanes and learning more about how they work, there is still no way to prevent them.

When Christopher Columbus was navigating and discovering places in Central America and the Caribbean, he was sailing into a hurricane. In his journals, he described the hurricane as follows: “Eyes never beheld the seas so high, angry, and covered by foam. The wind not only prevented our progress, but offered us no opportunity to run behind any headline for shelter. . . Never did the sky look more terrible. . . The lightning broke forth with such violence that each time I wondered if it had carried off my spars and sails; the flashes came with such fury and frightfulness that we all thought the ships would be blasted. All the time, the water never ceased to fall from the sky.”(7)

As Karl Turekian states in Global Environmental Changes, poets have also described these natural phenomena. There follows here a poem inspired by hurricanes written by Diane Brand. Born in Trinidad, Ms. Brand later immigrated to Toronto. She has been called “one of the best young poets writing in Canada today.” Though she currently lives in Canada, she writes about the weather in her native land.

Hurricane

Shut the windows

Bolt the doors

Big rain coming

Climbing up the mountain.

Gather in the clotheslines

Pull down the blinds

Big wind rising

Coming up the mountain.

Neighbors whisper

Dark clouds gather

Big rain coming

Climbing up the mountain.

Branches falling

Raindrops flying

Treetops swaying

People running

Big wind blowing

Hurricane: on the mountain.

In another poem, Diane Brand again writes about the weather, this time from the perspective of someone who has experienced a long drought and welcomes a rainfall.

Rain

It finally came

it beat on the house

it bounced on the flowers

it banged the tin roof

it rolled in the gutters it made the street muddy

it spilled on the village

it licked all the windows

it jumped on the hill.

It stayed for two days

and then it left.

Lesson Plan One: Mountains and Valleys

Objectives:

- To see that the students learn about the different levels and features of the earth’s crust

- To see that they learn how mountains are formed and the different types of mountains
- To enable the students to compare the difference between an arid and a fertile land, and to explain why this difference exists
-To enlarge the students' knowledge about people, the different styles of life in the mountains vs. the lowlands; to enable them to explain the difference

Words to Study:

fold arid
fault fertile
blockerosion

slabsslopes

domearch

Introduction:

After reviewing the formation of the earth, the earth's crust, etc., I will explain what mountains are, how they are formed, their different formations. The teacher will illustrate this lesson with colored charts and films if available.

Activities:

-Students will see books about mountains

-They will search on the computer about mountains

-They will prepare a list of products and animals of the mountains

-They will discuss different types of recreation in the mountains

-They will make their own mountains and valleys, etc. using clay of different colors and /or pieces of rock

Lesson Plan Two: The Difference Between Oceans and Rivers

Objectives:

After studying this subject, the student will be able to

-name some of the elements found in the ocean
-explain in a simple manner the relationship between the ocean and the weather (evaporation, heat, etc.)
-write a list of animals that dwell in the ocean

-explain about the coastline and its risks
-explain where rivers are formed and where they go
-write several sentences explaining the differences in use and quality between water from the ocean and water from the river

Accompanying this subject, I will show a film about rain forests, and the class will discuss the film.

Lesson Plan Three: An Introduction to Hurricanes

Objectives:

-that the students learn what a hurricane is and where it is formed
-that they learn the time of year in which hurricanes occur and what to do when we receive a warning that a hurricane is coming; (here I will provide the students with a list of the different supplies that the family needs in case a hurricane arises)

Procedure:

After reviewing about the weather, thunderstorms, and tornadoes, I will explain the similarity between tornadoes and hurricanes, noting that hurricanes are much larger and more dangerous. I will present a film about Hurricane Hugo, which caused alot of damage in Puerto Rico, where most of my students came from. After seeing the movie, the class will have the opportunity to discuss freely. They will be encouraged to explain their own experience or that of their families during the hurricane. After this session, the students will copy a list of supplies needed in case a hurricane warning is issued. Students will also copy a list of agencies and institutions that help victims of hurricanes and other disasters.

A List of Emergency Supplies Recommended by the American Red Cross:

These enable a family to live independently for 72 hours or more after a major disaster.

-water: 2 quarts to 1 gal. per person per day

-first aid kit: ample and freshly stocked

-first aid book: know how to use it

-food: canned or individually packaged, pre-cooked, or requiring minimal heat and water for preparation. Baby and pet food and other special needs foods.

-can opener

-blankets, sleeping bags

-radio and batteries

-critical medications and eyeglasses if needed

-fire extinguisher

-flash light: also fresh and spare batteries and bulb

-watch or clock

-sanitation supplies

-large plastic trash bags

-large trash can

-hand soap

-liquid detergent

-tooth paste and tooth brush

-shampoo

-feminine supplies

-toilet paper

-insect spray

-heavy shoes for every family member

-candles

-matches

-knife

-garden hose for fire fighting

-barbeque: charcoal and lighter fluid

-paper plates

-axe

-shovel

-broom

-screwdriver

-pliers

-hammer

-pen and paper

-car mini-survival kit

-small package of tissues

If someone leaves the house, leave a note telling where you can be found.

Organizations That Help In Times of Disaster:

In order to give my students the feeling and confidence that they and their families are not alone in a case of an emergency caused by a disaster, I will provide them with the names of different agencies and organizations that help when these disasters occur.

By doing this, I also hope to create in my students a sense of responsibility toward their families and their community.

CARE: Cooperative for American Relief to Everywhere
CRS: Catholic Relief Services
CWS: Church World Service. A division of overseas ministries of the National Council of Churches.
ICRC: International Committee of the Red Cross
ITU: International Telecommunications Union
NEC: National Emergency Committee
UNDRO: Office of the United Nations Disaster Relief
UNICEF: United Nations International Children's Funds
United Way
WFP: World Food Program
WHO: World Health Program
WMO: World Meteorological Organization

Conclusion to the Curriculum Unit:

It is my hope that the students who study this unit will come to see how important a role the physical environment plays in their lives. They will learn that the environment changes continuously: the earth rotates and with it come night and day, earthquakes cause cracks in the earth, mountains are thrown up, volcanoes explode, storms come and go. All these physical changes are determining factors in the changes that humans make in their lives. Changes in the earth have imposed the need for migration and immigration, for example. And changes in the earth have caused humans to adapt— to develop new skills for survival. For example, the Indians in South America learned to construct new styles of housing to protect themselves from the floods caused by El Nino and from earthquakes. Again, humans have learned how to deviate the rivers in order to protect nearby settlements from changes in the river's course.

As humans continue to adapt to environmental change, they need to take care to protect the fragile ecology; in doing so, we will be protecting the world for our children, ensuring that they have a healthy, strong future. I hope through the study of this curriculum unit that students will gain some understanding not only about living in their physical environment but also about protecting it for the future.

Note: For figures A to E, refer to the following texts:
Figures A and B: Lefkowitz, 1989: 11, 13.
Figures C, D and E: Taylor, 1993 B: 12, 13.

Endnotes

1. Our "Home and Space," *Geography Key Concepts and Basic Skills* by William. Lepkowitz, p.2.
2. *Global Environmental Change: Past, Present and Future* , Karl K. Turekian
3. Robert Bowen, *Surface Water,* p.4.
4. David Lambert, *Sea and Oceans* .
5. Jacques Costeau, *The Ocean World of Jacques Costeau* , p.10.
6. Introduction to *Seas and Oceans* , p.6.
7. Quoted in Dennis Brindell Fradin, *Disaster Hurricane* , p.26.

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Recommended Films and Videos

Be Your Own Weather Man

Big Wind the Destroyer Clear Water

Earth a Great Store House

Earth's Shape and Size

Exploring Storms

Global Warming

My Side of the Mountain

The Rainforest

Recycling

Why Do We Have Wind

Why Does the Weather Change?

Wind and Waves

Work of Running Water

Work of the Sea