Disaster Response Literacy Activity

Objectives

- The student will read attached pieces of literature outlining the recent disasters of the, 1989 San Francisco Earthquake, 2005 Katrina Hurricane, and the 1902 Mount Pelee Volcanic eruption.
- The student will create a list of vocabulary words from text that are predisposed to science literature, i.e. seismic, frontal, pyroclastic, and produce both a self-definition as well as a technical definition from a reliable source document.
- The student will work with others completing the assignment in groups of three to six peers discussing and debating the cause and effect of such wide scale damage to local environments, the loss of human life, and the concept of security within ones community.
- The student will theorize the type and extent of damage caused by an Apophis type impact. What actions can be taken for mitigation? How can society prepare for such an event?
- The student will write a reflective essay on preparedness for disaster response as they see government's responsibility toward its citizens and devise a suggested strategic plan for action that will safeguard the greatest number of people. Consider the concepts of cost and feasibility along with whom and how your plan will be executed.

Suggested Grade Levels

9th to 12th

Subject Areas

Language Arts
Integrated Science

Timeline

One to three class periods

National English Language Content Standards

NL-ENG.K-12.1 Reading for Perspective

Students read a wide range of print and nonprint texts to build an understanding of texts, of themselves, and of the cultures of the United States and the world; to acquire new information; to respond to the needs and demands of society and the workplace; and for personal fulfillment.

Among these texts are fiction and nonfiction, classic and contemporary works.

NL-ENG.K-12.3 EVALUATION STRATEGIES

Students apply a wide range of strategies to comprehend, interpret, evaluate, and appreciate texts. They draw on their prior experience, their interactions with other readers and writers, their knowledge of word meaning and of other texts, their word identification strategies, and their understanding of textual features (e.g., sound-letter correspondence, sentence structure, context, graphics).

NL-ENG.K-12.4 COMMUNICATION SKILLS

Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes.

NL-ENG.K-12.7 Evaluating Data

Students conduct research on issues and interests by generating ideas and questions, and by posing problems. They gather, evaluate, and synthesize data from a variety of sources (e.g., print and nonprint texts, artifacts, people) to communicate their discoveries in ways that suit their purpose and audience.

NL-ENG.K-12.11 PARTICIPATING IN SOCIETY

Students participate as knowledgeable, reflective, creative, and critical members of a variety of literacy communities.

NL-ENG.K-12.12 Applying Language Skills

Students use spoken, written, and visual language to accomplish their own purposes (e.g., for learning, enjoyment, persuasion, and the exchange of information).
Students conduct research on issues and interests by generating ideas and questions, and by posing problems. They gather, evaluate, and synthesize data from a variety of sources (e.g., print and nonprint texts, artifacts, people) to communicate their discoveries in ways that suit their purpose and audience.

Background

This lesson is appropriate for students studying science, language arts, or social studies. The students should have some prior knowledge of astronomy, geography, earth science and physics. Additionally, the student should have prior experience in inquiry-based approaches to study and be able to work collaboratively in groups as well as on their own. Review with students how society responds to disasters and at what scales that response is directed (local, regional, national or global). Provide students with an understanding of disaster types and demonstrate how they affect the infrastructure of the immediate area.

Materials

Pencil or pen, note/binder paper, reading handouts

Lesson

1. Have students read articles on the three disasters: 1989 San Francisco earthquake, Hurricane Katrina, Mount Pelee volcanic eruption.
2. Have students skim the articles and identify and record vocabulary terms that seem to be specific to science.
3. Have students construct self definitions as well as locating and recording definitions from a reliable source, i.e. dictionary, encyclopedia, for the above identified terms.
4. Have students reread the articles taking notes on specific or critical facts that relate to disasters, damage, cost to society, response, and mitigation strategies.
5. Have students work in small groups of three to six persons discussing and debating the cause and effect of disasters, the scale of damage to local environments, the loss of human life, the loss of resources, and the concept of security in ones own habitat.
6. Have groups devise mitigation strategies that may facilitate a decrease in the loss of the above items before, during, and after a disaster event.
7. Have students individually write a reflective essay on their lesson experience. Address the ideas of mitigation and recovery strategies.

Extensions

Students can explore this topic in detail in a number of ways. Start by having the students conduct research using peer reviewed sources from the Internet and library sources identifying and recording pertinent facts regarding potentially hazardous asteroids (PHA). Have students construct graphs and charts of objects that threaten the Earth and what period these threats can be expected to occur. Construct lab experiences that simulate impacts and measure, record, and analyze results. Have students visit

and interview local disaster response personnel: fire and police stations, rescue units, trauma teams at hospitals, etc. Have students visit local government officials and determine if there is a local disaster response plan, and if it adequately supports the local population.

Evaluation

Students can be graded both objectively and/or subjectively by the teacher. The vocabulary and the writing tasks can be evaluated in a standard completion mode. For the group work, create an evaluation tool or use the rubric on the following page.

Disaster Response Debate

Name: _____ Teacher: _____

Date: _____ Title of Work: _____

Skills	Criteria				Points
	1	2	3	4	
Helping The teacher observed the students offering assistance to each other.	*None* of the Time	*Some* of the Time	*Most* of the Time	*All* of the Time	____
Listening The teacher observed students working from each other's ideas.	*None* of the Time	*Some* of the Time	*Most* of the Time	*All* of the Time	____
Participating: The teacher observed each student contributing to the project.	*None* of the Time	*Some* of the Time	*Most* of the Time	*All* of the Time	____
Persuading: The teacher observed the students exchanging, defending, and rethinking ideas.	*None* of the Time	*Some* of the Time	*Most* of the Time	*All* of the Time	____
Questioning: The teacher observed the students interacting, discussing, and posing questions to all members of the team.	*None* of the Time	*Some* of the Time	*Most* of the Time	*All* of the Time	____
Respecting: The teacher observed the students encouraging and supporting the ideas and efforts of others.	*None* of the Time	*Some* of the Time	*Most* of the Time	*All* of the Time	____
Sharing: The teacher observed the students offering ideas and reporting their findings to each other.	*None* of the Time	*Some* of the Time	*Most* of the Time	*All* of the Time	____
				Total Points	____

The 1989 San Francisco Earthquake

Death, destruction, and havoc were again visited upon the San Francisco area in 1989. Reminiscent of the 1906 earthquake, the earth shook, like a table bumped, causing a house of cards to fall.

The Loma Prieta — literally, dark knoll — earthquake occurred on October 17, 1989, in the greater San Francisco Bay Area in California at 5:04 p.m. local time and measured 7.1 on the Richter magnitude scale. The earthquake lasted for 15 to 20 seconds. Its epicenter was at geographical coordinates 37.04° N 121.88° W, near Loma Prieta Peak in the Santa Cruz Mountains, about 10 miles northeast of the city of Santa Cruz, California, in the Forest of Nisene Marks State Park. The fault rupture did not break the ground surface. The focal depth was 11 miles, which is unusually deep. Typical California earthquake focal depths are 4 to 6 miles. That earthquake was the largest to occur in the San Francisco Bay area since 1906.

Sources place the death toll at between 63 to 68 people. Deaths in Santa Cruz occurred when brick storefronts and sidewalls in the historic downtown (what was then called the Pacific Garden Mall) tumbled down on people exiting the buildings.

The earthquake caused severe damage as far as 70 miles away, most notably in San Francisco, Oakland, the San Francisco Peninsula, and in areas closer to the epicenter in the communities of Santa Cruz, Watsonville, and Los Gatos. Extensive damage also occurred in San Francisco's Marina District, where many expensive homes built on filled ground collapsed from liquefaction of soil used over the years to fill in the waterfront and then built upon.

In addition, more than 1,000 landslides and rock falls occurred in the epicenter zone in the Santa Cruz Mountains. One slide, on State Highway 17, disrupted traffic for about a month. Property damage was estimated at $6 billion.

The earthquake interrupted the World Series between the San Francisco Giants and the Oakland Athletics. Fortunately, less than half of the 65,000-plus fans had reached their seats, lessening the load on the structure of the stadium.

Because the quake occurred during the evening rush hour, there could have been a large number of cars on the freeways at the time, which might have endangered many hundreds of commuters. Fortunately, in an unusual convergence of events, many people had left work early or were participating in World Series early after-work parties. Therefore, the usually crowded highways bore exceptionally light traffic at the time.

One of the major impacts of the earthquake on everyday life was transportation. The earthquake caused the Cypress Viaduct to collapse, resulting in 42 deaths. The viaduct was a raised freeway section that was part of the Nimitz freeway in Oakland, which is Interstate 880. The viaduct had two traffic decks. Resonant vibration caused 50 of the 124 spans of the Viaduct to collapse. The reinforced concrete frames of those spans were mounted on weak soil. As a result, the natural frequency of those spans coincided with the forcing frequency of the earthquake ground motion. The viaduct structure thus amplified the ground motion. The spans suffered increasing vertical motion. Cracks formed in the support frames. Finally, the upper roadway collapsed, slamming down on the lower road, crushing the cars on the lower deck.

The earthquake forced the closure and demolition of San Francisco's Embarcadero Freeway (Interstate 480); that demolition opened up San Francisco's Embarcadero waterfront to new development. The concrete freeway, which ran along San Francisco's waterfront and was never completed, was replaced with a ground-level boulevard. Seismic damage also forced the long-term closure of Interstate 280 in San Francisco (north of US-101), another concrete freeway that had never been completed on its originally planned route. The highway remained closed for seven years, with its repair experiencing numerous delays.

The Loma Prieta earthquake irrevocably changed the San Francisco Bay Area's transportation landscape. The quake also forced seismic retrofitting of all San Francisco Bay Area bridges.

The quake also caused an estimated $6 billion in property damage, the costliest natural disaster in U.S. history at the time. It was the largest earthquake to occur on the San Andreas Fault since the great 1906 San Francisco earthquake. Private donations poured in to aid relief efforts and on October 26, President Bush signed a $3.45 billion earthquake relief package for California.

Hurricane KATRINA

Hurricane Katrina was the costliest and one of the deadliest hurricanes in the history of the United States. It was the sixth-strongest Atlantic hurricane ever recorded and the third-strongest land falling U.S. hurricane ever recorded. Katrina formed in late August during the 2005 Atlantic hurricane season and devastated much of the north-central Gulf Coast of the United States. Most notable in media coverage were the catastrophic effects on the city of New Orleans, Louisiana. Katrina's sheer size devastated the Gulf Coast over 100 miles (160 km) away from its center.

Katrina was the eleventh named storm, fifth hurricane, third major hurricane, and second Category 5 hurricane of the 2005 Atlantic season. It formed over the Bahamas on August 23, 2005, and crossed southern Florida as a moderate Category 1 hurricane before strengthening rapidly in the Gulf of Mexico and becoming one of the strongest hurricanes ever recorded in the Gulf. The storm weakened considerably before making its second and third landfalls as a Category 3 storm on the morning of August 29 in southeast Louisiana and at the Louisiana/Mississippi state line, respectively. The storm surge caused severe or catastrophic damage along the coastlines of Alabama, Mississippi and Louisiana, including the cities of Mobile (Alabama), Biloxi and Gulfport (Mississippi), and Slidell (Louisiana). Levees separating Lake Pontchartrain and Lake Borgne from New Orleans were breached by the surge, ultimately flooding 80% of the city and many areas of neighboring parishes (counties). Severe wind damage was reported well inland. Katrina is estimated to be responsible for $81.2 billion (2005 US dollars) in damages, making it the costliest hurricane in U.S. history. The storm killed at least 1,836 people, making it the deadliest U.S. hurricane since the 1928 Okeechobee Hurricane. Criticism of the federal, state and local governments' reaction to the storm was widespread and resulted in an investigation by the United States Congress and the resignation of FEMA head Michael Brown.

Katrina maintained hurricane strength well into Mississippi, but weakened thereafter, finally losing hurricane strength more than 150 mi (240 km) inland near Jackson, Mississippi. It was downgraded to a tropical depression near Clarksville, Tennessee, but its remnants were last distinguishable in the eastern Great Lakes region on August 31, when it was absorbed by a frontal boundary. The resulting extra tropical storm moved rapidly to the northeast and affected Ontario and Quebec. Voluntary and mandatory evacuations were issued for large areas of southeast Louisiana as well as coastal Mississippi and Alabama. About 1.2 million residents of the Gulf Coast were covered under a voluntary or mandatory evacuation order

As of May 19, 2006, the confirmed death toll (total of direct and indirect deaths) stood at 1,836, mainly from Louisiana (1,577) and Mississippi (238).[18][19] However, 705 people remain categorized as missing in Louisiana, so this number is not final even nine months after the storm. Many of the deaths are indirect, but it is almost impossible to determine the exact cause of some of the fatalities

Federal disaster declarations covered 90,000 square miles (233,000 km²) of the United States, an area almost as large as the United Kingdom. The hurricane left an estimated three million people without electricity. On September 3, 2005, Homeland Security Secretary Michael Chertoff described the aftermath of Hurricane Katrina as "probably the worst catastrophe, or set of catastrophes," in the country's history, referring to the hurricane itself plus the flooding of New Orleans.

The heavy winds and storm surges from Katrina severely weakened the city's levee system, and there were reports of extensive failures of the levees and floodwalls protecting New Orleans, Louisiana and surrounding communities. The Mississippi River Gulf Outlet (MR-GO) breached its levees in approximately 20 places, flooding much of east New Orleans, most of Saint Bernard Parish and the East Bank of Plaquemines Parish. The major levee breaches in the city included breaches at the 17th Street Canal levee, the London Avenue Canal, and the wide, navigable Industrial Canal, which left approximately 80% of the city flooded. Most of the major roads traveling into and out of the city were damaged. The only routes out of the city were the westbound Crescent City Connection and the Huey P. Long Bridge, as the I-10 twin span bridge traveling eastbound towards Slidell, Louisiana had collapsed.

Subsequently, criticism from politicians, activists, pundits and journalists of all stripes has been directed at the local, state and federal governments headed by Mayor Ray Nagin of New Orleans and Louisiana Governor Kathleen Blanco. Nagin and Blanco were criticized for failing to implement New Orleans' evacuation plan and for ordering residents to a shelter of last resort without any provisions for food, water, security, or sanitary conditions. Perhaps the most important criticism of Nagin is that he delayed his emergency evacuation order until 19 hours before landfall, which led to hundreds of deaths of people who (by that time) could not find any way out of the city

Mount Pelee Eruption

Mount Pelée is infamous for its 1902 eruption and the destruction that resulted, the worst volcanic disaster of the 20th century. The eruption caused about 26,000 to 36,000 casualties and destroyed Saint-Pierre.Though it was previously dormant, Mount Pelée began to erupt on April 25, 1902. In early April, excursionists noted the appearance of sulfurous vapors emitting from fumaroles near the mountaintop. This was not regarded as important, as fumaroles had been appearing and disappearing in the past.

On April 23 the mountain caused a light rain of cinders on its southern and western side, together with sharp underground shocks.

On April 25, the mountain emitted a large cloud containing rocks and ashes from its top, where the Étang Sec - a dry basin - was located. The ejected material did not cause a meaningful amount of damage.

On April 26, the area was dusted by volcanic ash from a next eruption; the public authorities still did not see a reason to worry.

On April 27, several excursionists climbed the mountaintop to find Etang Sec filled with water, forming a lake 180 meters across. There was a 15-meter high cone of volcanic debris built up on one side, feeding the lake with a steady stream of boiling water. Sounds resembling a cauldron with boiling water were heard from deep underground. The strong smell of sulfur was all over the city, 4 miles away from the volcano, causing discomfort to people and horses.

On April 30, the rivers Roxelane and Riviere des Peres swelled, carrying boulders and trees from the mountaintop. The villages of Precheir and Ste. Philomene were receiving a steady stream of ashes.

At 11:30 a.m. on May 2, the mountain produced loud detonations, earthquakes, and a massive pillar of dense black smoke. Ashes and fine-grained pumice covered the entire northern half of the island. The detonation continued in 5-6 hour intervals. This led the local newspaper Les Colonies to indefinitely postpone the proposed picnic on the mountain, originally planned for May 4. Farm animals started dying from hunger and thirst, as their sources of water and food were contaminated with ash.

On Saturday, May 3, the wind blew the ash cloud northwards, alleviating the situation in St Pierre. The next day the ash fall intensified, and the communication between St Pierre and the Precheur district was severed. The ash cloud was so dense that the coastal boats feared to navigate through it. Many citizens decided to evacuate, filling the capacity of the steamer lines. The area was covered with a layer of fine, flour-like white ash

On Monday, May 5, the mountain apparently calmed down somewhat; however, at about 1 PM, the sea suddenly receded about 100 meters and then rushed back, flooding parts of the city, and a large cloud of smoke appeared westwards of the mountain. One wall of the Etang Sec crater collapsed and propelled a mass of boiling water and mud, or lahar, into Riviere Blanche, flooding the Guérin sugar works and burying about 150 victims under 60 to 90 meters of mud. Refugees from other areas flew into St Perre. That night, the atmospheric disturbances disabled the electric grid, sinking the city into darkness and adding to the confusion. The next day, at about 2 AM, loud sounds were heard from deep within the mountain.

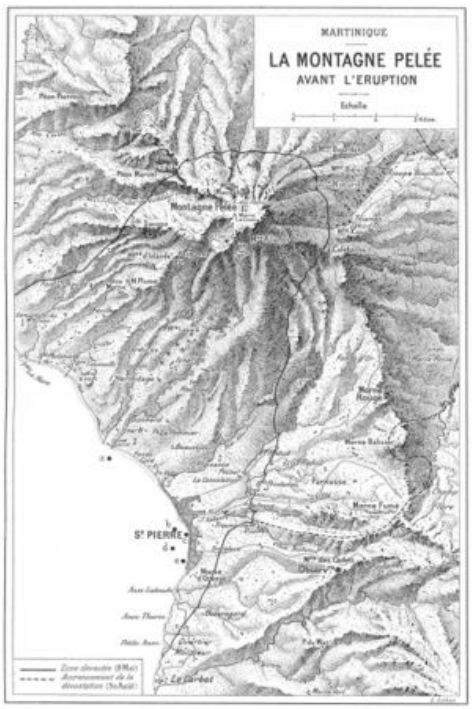
On Wednesday, May 7, at around 4 AM, the mountain stepped up its activity; the clouds of ash caused numerous lightning around the mountaintop, and both the craters glowed reddish orange into the night. Through the day, people were leaving the city, but more people from the countryside were attempting to find refuge in the city, increasing its population by several thousand. The newspapers still claimed the city was safe. News of the volcano Soufrière erupting on the nearby St. Vincent island reassured the people that the internal pressures in the mountain were being relieved. Not everyone was reassured, though; Captain Marina Leboffe, of the barque Orsolina, left the harbor with only half of the sugar cargo loaded, despite shippers' protests, clearance refused by the port authorities, and threats of being arrested. However, Governor Moutett and his lady stayed in the city. By the evening, the mountain's tremors seemed to calm down again.

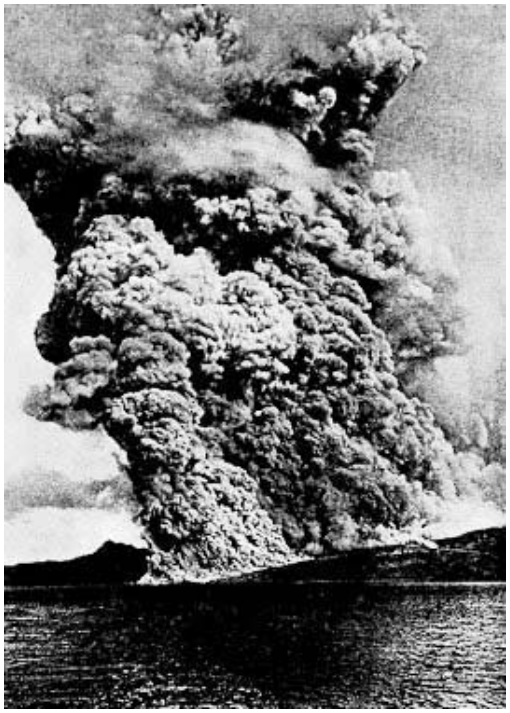
The main eruption, on May 8, 1902, on the Ascension Day, destroyed the town of Saint-Pierre, about 4 miles south of the peak. In the morning, people were observing the fireworks the mountain was showing off. The night shift telegraph operator was sending the reports of the volcano's activity, to the operator at Fort-de-France, claiming no significant new developments; his last transmission was

"Allez", handing over the line to the remote operator. It was 7:52; the next second the telegraph line went dead. A cable repair ship had the city in direct view; the upper mountainside ripped open and a dense black cloud shot out horizontally. A second black cloud rolled upwards, forming a gigantic mushroom cloud and darkening the sky in 50 miles radius. The initial speed of both clouds was later calculated to over 670 kilometers per hour

The horizontal pyroclastic cloud was hugging the ground, speeding down towards the city of Saint Pierre, appearing black and heavy, glowing hot from the inside. In under a minute it reached the city, instantly igniting everything combustible it came in contact with, covering the entire city. A rush of wind followed, this time towards the mountain. Then came a half-hour downpour of muddy rain mixed with ashes. For the next several hours, all communication with the city was severed. Nobody knew what was happening, nor who had authority over the island, as the governor was unreachable and his status unknown. Some survivors were picked from the sea; mostly badly burned sailors, who had been blown into the sea by the blast and then clung for hours to floating debris. A warship arrived towards the shore at about 12:30, but the heat prevented landing until about 3 PM. The city burned for several more days
The area devastated by the pyroclastic cloud covered about 8 square miles, with the city of St. Pierre taking its brunt. The cloud consisted of superheated steam and volcanic gases and dust, with temperatures reaching over 1000 °C.

Saint Pierre, which then served as the island's capital, had a population of some ~28,000, which was swelled by refugees from the minor explosions and mud flows first emitted by the volcano. There were pitifully few survivors: Ludger Sylbaris, a prisoner held in an underground cell in the town's jail (later pardoned), and Léon Compere-Léandre, a man who lived at the edge of the city. Some sources also list Havivra Da Ifrile, a little girl. One woman, a housemaid, also survived the pyroclastic flow but perished soon after; the only thing she remembered from the event was sudden heat. She died very shortly after being discovered. Included among the victims were the passengers and crews of several ships docked at Saint Pierre.





Resources

http://www.sfmuseum.org/1906/89.html

http://www.multicians.org/thvv/earthquake.html

http://en.wikipedia.org/wiki/Loma_Prieta_earthquake

http://www.nhc.noaa.gov/

http://en.wikipedia.org/wiki/Hurricane_Katrina

http://www.weather.com/newscenter/tropical/

http://www.geology.sdsu.edu/how_volcanoes_work/Pelee.html

http://www.findarticles.com/p/articles/mi_m1134/is_8_111/ai_92284529