

Curriculum Mapping For Natural Disasters

Unit I - The Science of Natural Disasters

COURSE: NATURAL DISASTERS

GRADE LEVELS: 11, 12

SUMMER 2008

MAIN/GENERAL TOPIC:	SUB-TOPIC:	ESSENTIAL QUESTIONS	WHAT THE STUDENT WILL KNOW OR BE ABLE TO DO:	SKILLS:	WHEN STUDENT DOES IT:	ASSESSMENTS:
The Science of Natural Disasters	Scientific Inquiry	What are the purposes of science?	The purposes are to understand natural phenomena, to solve problems, to develop a body of knowledge about the world, to develop and apply technology	Recognize the relevance and importance of science	Weeks 1-3	Student copies of numerous current articles to be read and summarized in the margins for questioning and discussion
	The Scope and Boundaries of Science	How are science, religion, and other disciplines different from each other?	Recognize the scope and boundaries of science Compare and contrast the disciplines of science, philosophy, and religion	Give examples which are appropriate and inappropriate for the application of scientific inquiry		
	Society and Science	How do education, government, lobbying groups, business, and the media affect science and public knowledge and opinion of science?	Understand, and use verbally and in writing, the terms <i>wisdom, values, ethics, beliefs, supernatural, revealed truth, logic, reasoning, rational, empirical, testable, falsifiable, fact, law, hypothesis, theory, skepticism, primary & secondary sources, internal and external validity, double-blind, placebo, professional journal, peer review, duplication, think tank</i>	Read, assess, summarize and discuss the interactions of science with other societal institutions, disciplines and groups Filter and assess information from various media and assess it's scientific validity, relevance and importance	On-going	
	Natural Disasters	Why is the study of ND's important?	Distinguish hazards, disasters and catastrophes			

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	<p>Role of History in Understanding Hazards</p> <p>Fundamental Concepts of Natural Hazards</p>	<p>How is history useful in studying disasters?</p> <p>What are the most basic and important principles in understanding natural disasters?</p>	<p>Damage and human mortality</p> <p>Understand how history can help us understand, predict, mitigate and even prevent natural disasters</p> <ol style="list-style-type: none"> 1. Hazards are predictable from scientific evaluation 2. Risk analysis is important to understanding effects of hazardous processes 3. Linkages exist between different hazards, as well as between those hazards and the physical environment 4. Hazardous events are now more frequently producing disasters, and events that used to cause disasters are now more frequently causing catastrophes 	<p>Demonstrate through data collection, mapping and analysis the relationships between location, frequency, patterns and precursors of events and predictions of future events</p> <p>Use data on probabilities and consequences to assess risk for given disasters</p> <p>Relate disasters to the natural environment and to each other (ex: tectonic faults - earthquakes – tsunami)</p> <p>Understand the linkages between human population growth with attendant unwise land-use practices, and the increasing magnitude and frequency of natural disasters and catastrophes</p>	<p>On-going</p>	<p>Unit Test – the Science of Natural Disasters</p>

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	Climate change	<p>How are magnitude and frequency related to impacts?</p> <p>How does climate change influence natural hazards?</p>	<p>5. Consequences of disasters can be minimized</p> <p>1. With natural hazards, magnitude and frequency are generally inversely related</p> <p>2. Events of moderate magnitude and frequency generally cause the most significant, lasting impacts to the Earth and humans</p> <p>Global and regional climate changes affect the locations, magnitudes and often frequencies of such events as storms, landslides, floods, coastal erosion, drought and fires</p> <p>Climate change is expected to affect desertification, food production, global human population shifts, social and political tensions and land resource conflicts</p>	<p>Include an integrated approach involving science, land-use planning and regulation, engineering and proactive preparedness, in researching how humans can address problems associated with natural disasters. Demonstrate the knowledge to respond appropriately to emergency watches and warnings.</p>	<p>On-going</p> <p>Week 3</p>	

Unit II – Extraterrestrial Threats
COURSE: NATURAL DISASTERS
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MAIN/GENERAL TOPIC:	SUB-TOPIC:	ESSENTIAL QUESTIONS	WHAT THE STUDENT WILL KNOW OR BE ABLE TO DO:	SKILLS:	WHEN STUDENT DOES IT:	ASSESSMENTS:
Extraterrestrial Threats	Earth's Place in Space	What astronomical objects and events threaten Earth?	Know the difference between and be able to articulate the threats faced from asteroids, comets, meteors, coronal holes, solar flares, gamma ray bursts and supernovae			Redline readings on the Tunguska Event and many other impact articles
	Airbursts and impacts	What are the main types of threats from near Earth objects?	Understand the physical processes associated with airbursts and impact craters Be familiar with existing known object threats such as Apophis	Design, set up, and carry out a series of physical tests to understand the effects of object diameter, density and velocity on resultant impact craters		NEO Impact Lab
	Effects of Impacts	How have impacts affected Earth and life?	Be familiar with impact craters around the world Understand the possible causes of mass extinction Know the evidence for the impact hypothesis that produced the mass extinctions at the K-T and Pleistocene-Holocene boundaries Know the likely physical, chemical and biological consequences of impact from a large asteroid or comet	Using Web 2.0 resources such as Google Docs or Zoho.com, collaboratively research one of a suggested list of related topics and publish a web site and related documents and presentations		Published web site w/ documents, presentations
	Risk and Mitigation	What are the probabilities of impacts of various magnitudes	Understand the risk of impact or airburst of extraterrestrial objects and how that risk might be minimized			

Unit II – Extraterrestrial Threats

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		<p>How are impact events linked with other natural hazards?</p> <p>How can impact hazards be minimized?</p>	<p>Understand the linkages with tsunamis, wildfire, earthquake, mass wasting, climate change and volcanism</p> <p>The Torino Impact Scale</p>	<p>Apply the Torino Impact Scale appropriately to sample events</p>		<p>Unit Test – Extraterrestrial Threats</p>

Unit III – Geologic Hazards

COURSE: NATURAL DISASTERS

GRADE LEVELS: 11, 12

MAIN/GENERAL TOPIC:	SUB-TOPIC:	ESSENTIAL QUESTIONS	WHAT THE STUDENT WILL KNOW OR BE ABLE TO DO:	SKILLS:	WHEN STUDENT DOES IT:	ASSESSMENTS:
Geologic Hazards	Earthquakes	Who is affected?	Earth quakes affect people across the globe, sometimes far from the epicenter.	Demonstrate how scientists measure, locate and compare earthquakes		San Andreas Fault Hazards Lab
		How dangerous are earthquakes?	Earthquakes are especially dangerous because we cannot predict them, in order to prepare and evacuate.	Be able to describe the difference between moment magnitude and Mercalli Intensity		
			Be familiar with processes of faulting, tectonic creep, and the formation of seismic waves	Identify how earthquakes are linked to landslides, fires and tsunamis		Earthquake Hazards Lab
			Know which regions are most at risk and why	Identify earthquake hazards using maps		Hazard City software: Earthquake Damage Assessment
		What happens during an earthquake?	Understand and investigate effects such as shaking, ground rupture and liquefaction	Investigate and test the effects of shaking on various soils, levels of saturation, and built structures		Shake Table Project
	What are humans doing wrong, and what can we do better?	Know how humans interact with and affect earthquake hazards	Demonstrate knowledge of how to reduce risk, and what to do during, an actual earthquake			
	Tsunamis	How destructive can tsunamis be?	Know that tsunamis are among the most destructive of all natural hazards			Published web site w/ documents, presentations
How do tsunamis form and develop?		Understand how earthquakes, landslides and volcanoes cause tsunamis and how they propagate				

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MAIN/GENERAL TOPIC:	SUB-TOPIC:	ESSENTIAL QUESTIONS	WHAT THE STUDENT WILL KNOW OR BE ABLE TO DO:	SKILLS:	WHEN STUDENT DOES IT:	ASSESSMENTS:
	Volcanoes	<p>Who is affected?</p> <p>What happens during a tsunami?</p> <p>What can we do better?</p> <p>Are volcanoes all the same?</p> <p>Who is affected?</p>	<p>Tsunamis are common in some coastal regions and rare in others. Know which regions are most at risk and why.</p> <p>Be familiar with processes of tsunami formation and development</p> <p>Understand the effects and hazards posed to coastal areas</p> <p>Know how humans interact with and affect earthquake hazards</p> <p>Understand how we can minimize risk, and recognize adjustments we can make to protect ourselves</p> <p>Know the different types of volcanoes and their associated features</p> <p>Active and dormant volcanoes are found all over the globe but are not evenly distributed – understand the relationship of volcanism to plate tectonics</p> <p>Know what geographic regions are at risk</p>	<p>Use maps to analyze tsunami risk</p> <p>Demonstrate knowledge of how to reduce risk, and what to do during, an actual tsunami</p>		<p>Read, red-line, and report out on the tsunami of December, 2004</p> <p>Hazard City software: Tsunami and Storm Surge</p> <p>Published web site w/ documents, presentations</p>

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	Mass Wasting & Subsidence	<p>What happens during and after an eruption?</p> <p>What can we do better?</p> <p>What is mass wasting?</p> <p>What different hazards are considered mass wasting?</p> <p>How do we determine risk for an area?</p>	<p>Know the effects and how volcanoes are linked to other natural hazards, such as landslides, floods, and tsunamis.</p> <p>Recognize the potential benefits of eruptions</p> <p>Understand how we can minimize the volcanic hazard</p> <p>Know what adjustments we can make to avoid death and damage from volcanoes</p> <p>Mass wasting includes any downslope movement of earth materials</p> <p>Examples of mass wasting are <i>landslides, earthflows, debris flows, rock falls, avalanches, slumping, creep, solifluction, sink hole</i></p> <p>Understand how slope processes relate to the different types of mass wasting hazards</p> <p>Know the forces that act on slopes and how they affect slope stability</p>	<p>Map and analyze hazards on a real volcano</p> <p>Analyze aerial photographs of a volcano and recognize the various hazardous features</p> <p>Demonstrate knowledge of how to reduce risk, and what to do during, an actual volcanic eruption</p>		<p>U.S.G.S. Mt. Rainier Report and Maps</p> <p>Published web site w/ documents, presentations</p>

Unit III – Geologic Hazards

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GRADE LEVELS: 11, 12

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	Geomagnetic Fluctuations	<p>What happens during and after a mass wasting event?</p> <p>What can we do better?</p> <p>What are geomagnetic fluctuations?</p> <p>Why are they a concern?</p> <p>How do we determine risk?</p> <p>What can we do to prepare?</p>	<p>Know what geographic regions are at risk from mass wasting</p> <p>Know the effects of landslides</p> <p>Understand how mass wasting is related to other natural hazards, such as storms and floods</p> <p>Understand how people can affect the landslide hazard</p> <p>Be familiar with adjustments we can make to avoid death and damage</p> <p>Know that the Earth's core produces a magnetosphere which protects the Earth from Solar wind</p> <p>The magnetosphere has fluctuated and reversed several times in geologic history</p> <p>Know what hazards could present during a geomagnetic reversal or weakening</p> <p>Know what steps can be taken to prepare for a further weakening of the magnetosphere</p>	<p>Demonstrate knowledge of how to reduce risk, and what to do during, an actual landslide</p>		<p>Unit Test – Geologic Hazards</p>

Unit IV – Severe Weather and Climate Change

COURSE: NATURAL DISASTERS

GRADE LEVELS: 11, 12

MAIN/GENERAL TOPIC:	SUB-TOPIC:	ESSENTIAL QUESTIONS	WHAT THE STUDENT WILL KNOW OR BE ABLE TO DO:	SKILLS:	WHEN STUDENT DOES IT:	ASSESSMENTS:
Storms	Thunderstorms	<p>What should every person know about severe weather events?</p> <p>When do thunderstorms occur?</p> <p>What atmospheric conditions are necessary?</p> <p>What are the stages of development?</p> <p>What are some features of severe storms?</p>	<p>Know the different types of severe weather events</p> <p>Know the main effects of severe weather events</p> <p>Know the linkages of severe weather events to other natural hazards</p> <p>Understand how humans interact with severe weather events</p> <p>Know how we can minimize the impacts of severe weather hazards</p> <p>Spring and summer, during the afternoon and evening</p> <ol style="list-style-type: none"> 1. Ample water vapor 2. Vertical temperature gradient 3. Updraft <ol style="list-style-type: none"> 1. Cumulus stage 2. Mature stage 3. Dissipating stage <p>Be familiar with <i>wind shear, mesoscale convective systems, squall lines, supercells, downdrafts, outflow boundaries, gust fronts, dry lines, microbursts, derechos, hail</i></p>	<p>Demonstrate knowledge of how to reduce risk, and what to do during, an actual thunderstorm</p>		

Unit IV – Weather and Climate Impacts

COURSE: NATURAL DISASTERS

GRADE LEVELS: 11, 12

MAIN/GENERAL TOPIC:	SUB-TOPIC:	ESSENTIAL QUESTIONS	WHAT THE STUDENT WILL KNOW OR BE ABLE TO DO:	SKILLS:	WHEN STUDENT DOES IT:	ASSESSMENTS:
Heat waves, Drought and desertification	Fog	What is fog?	Fog is a cloud on the ground.			
	Heat waves	When and why is fog hazardous?	Discuss some famous disasters that occurred because of fog			
		What is a heat wave?	Define heat wave.	Demonstrate knowledge of how to reduce risk, and what to do during, an actual heat wave		
		What are some features of heat waves?	Be familiar with <i>high pressure ridges, the heat index, heat stress, dehydration, heat exhaustion, heat stroke</i>			
		How do heat waves form and develop?		Be able to discuss <i>vulnerable populations, the need for warning systems, cooling systems, and public education</i>		
	Drought and desertification	Where and how often do heat waves occur?				
What is drought?		Drought is an extended period of unusually low precipitation that produces a shortage of water for plants, animals and people.				
		How is drought related to other hazards?	Extended drought can cause <i>water shortages, agricultural failure, famine, desertification and loss of human infrastructure (ex: hydroelectric power)</i> Be familiar with the terms <i>recharge, surplus, deficit</i>	Be able to discuss how <i>deforestation and climate change are related to drought and human catastrophes such as famine</i>		

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Floods		<p>How common is flooding, and why do rivers flood?</p> <p>What are the different types of floods?</p> <p>Who is at risk?</p> <p>What are some important facts about flooding?</p>	<p>Know that flooding is the most universally experienced natural hazard, and understand the processes involved in flooding</p> <p>Understand the differences between <i>flash floods</i> and <i>downstream floods</i></p> <p>Know what national and local regions are at risk and why</p> <p>Know the effects of flooding and linkages with other natural hazards. In particular, recognize the prevalence and severity of secondary impacts such as <i>water pollution, disease, hunger, homelessness, failure of human infrastructure and fire</i></p> <p>Be familiar with the terms <i>levee, floodplain, floodway, 100-year flood, 500-year flood, drainage basin, watershed, discharge, effluent river, affluent river, tributary, alluvial fan, distributary channels, channel patterns, overbank flow, avulsion, river stage, hydrograph, flood stage, recurrence interval, gauging station, discharge-frequency curve, channelization, channel restoration, rip-rap, stormwater management plan, Army Corps of Engineers, flood insurance, FEMA</i></p>	<p>Analyze FEMA flood maps for the Ballston Spa region</p>		<p>Read, redline, summarize and discuss the VILLAGE OF BALLSTON SPA DISASTER PLAN</p>

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Coastal hazards and hurricanes	Coastal Hazards	Do floods have benefits?	Recognize the important benefits that floods provide			
		How do people interact with and affect flooding?	Know that many ways that people affect and are affected by floods, and the adjustments we can make to minimize death and damage			
		What are some coastal hazards?	Coastal hazards include rip currents, erosion and rising sea level			
		Who is at risk?	Know what geographic regions are at risk			
		What are the impacts and benefits?	Understand the effects of coastal hazards			
		How do humans act to worsen or minimize coastal hazards?	Know the benefits derived from coastal processes			
	Hurricanes	What are some important basic facts about hurricanes?	Understand how human use of the coastal zone affects hazards, and what we can do to minimize them			
		What are some important basic facts about hurricanes?	Know that hurricanes are the most powerful storms on Earth, and are among the most deadly and costly natural disasters. Katrina was the most expensive disaster in all of human history.			

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Wildfires		<p>What causes hurricanes, and how do they develop and end?</p> <p>Who is affected?</p> <p>What are the impacts?</p> <p>What can / should we do?</p>	<p>As climate changes and sea level rises, scientists expect hurricanes to pose an ever greater hazard.</p> <p>Understand the weather conditions that create, maintain and dissipate cyclones and hurricanes</p> <p>Understand the difficulties in forecasting cyclone behavior</p> <p>Know what geographic regions are at risk</p> <p>Understand the effects of cyclones in coastal and inland areas</p> <p>Recognize linkages with other hazards</p> <p>Understand adjustments to minimize damage and personal injury, and prudent actions to take for hurricane and extratropical storm watches and warnings</p>			

Unit IV – Weather and Climate Impacts

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GRADE LEVELS: 11, 12

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Climate Change						