Location, Location, Location… *Lesson Plan*

Students learn about latitude, longitude, and the potential effects of climate change.

Lesson Summary: In this lesson, students will learn to read and recognize coordinates on a map and gain an understanding of latitude and longitude. Additional time will be spent discussing how countries in different regions could potentially serve as a model for predicting the effects of climate change here in Florida.

Grade Level: 6^{th} – 8^{th}

Time Allotted: 2 class periods (approximately 40 minutes each)

Performance Objectives

References are to the Next Generation Sunshine State Standards (2007).

Social Studies

SS.A.4.3.2 The student knows the role of physical and cultural geography in shaping events.

SS.A.6.3.2 The student knows the unique geographic and demographic characteristics that define Florida as a region.

SS.A.6.3.5 The student understands how Florida has allocated and used resources and the consequences of those economic decisions.

Science

SC.6.E.7.5: Explain how energy provided by the sun influences global patterns of atmospheric movement and the temperature differences between air, water, and land.

SC.6.E.7.7 Investigate how natural disasters have affected human life in Florida.

SC.7.E.6.4: Explain and give examples of how physical evidence supports scientific theories that Earth has evolved over geologic time due to natural processes.

SC.7.E.6.6: Identify the impact that humans have had on Earth, such as deforestation, urbanization, desertification, erosion, air and water quality, changing the flow of water.

SC.8.N.1.6: Understand that scientific investigations involve the collection of relevant empirical evidence, the use of logical reasoning, and the application of imagination in devising hypotheses, predictions, explanations and models to make sense of the collected evidence.

Prior Knowledge

Familiarity with reading a map, atlas, globe, or similar reference tool is recommended but not required.

Topic Overview

When teaching latitude and longitude, students seldom have the opportunity to work with familiar places in their own community. The opportunity to find precise locations beyond degrees is also

limited. This module provides a necessary refinement of this skill by identifying local locations (lakes) in terms of degrees, minutes and seconds.

Also, students will learn that climate changes varies significantly across latitudes: the further north or south you move, the more different the climate becomes. Using latitude a frame of reference, students will learn about more southerly, hotter climates and be asked to predict what their current location might look like if climate change continues to increase global temperatures and alter existing climates.

Key Vocabulary

Absolute location
Description of a geographic point that is independent of a viewer's location. Example: My school is on the northeast corner of Main and First Street in Orlando, Florida.

Climate change
Major changes in temperature, rainfall, snow or wind patterns lasting for decades or longer. Climate change may result from: (1) natural factors, such as changes in the sun's energy or slow changes in the Earth's orbit around the sun; (2) natural processes within the climate system (e.g. changes in ocean circulation); (3) human activities that change the atmosphere's makeup (e.g. burning fossil fuels) and the land surface (e.g. cutting down forests, planting trees, building developments in cities and suburbs etc.)

Degree
The 360th part of a complete angle or turn, often represented by the sign°, as in 45°, which is read as 45 degrees. In geography, degrees are based on the prime meridian and the equator (increasing the further you move from either one).

Equator
An imaginary line that bisects the earth into northern and southern hemispheres; each point on the equator is equidistant from the North and South Poles.

Global Positioning System (GPS)
A satellite-based navigation system made up of a network of 24 satellites placed into orbit by the U.S. Department of Defense. GPS was originally intended for military applications, but in the 1980s, the government made the system available for civilian use.

Latitude
The angular distance north or south from the equator of a point on the earth's surface, measured on the meridian of the point.

Longitude
The angular distance east or west on the earth's surface, measured by the angle contained between the meridian of a particular place and some prime meridian, as that of Greenwich, England, and expressed either in degrees or by some corresponding difference in time.

Minute
The sixtieth part of a degree of angular measure, often represented by the sign ', as in 12 10", which is read as 12 degrees and 10 minutes.

Prime meridian
Also called the Greenwich Meridian (because it passes through a point in Greenwich, England), this is an imaginary line that bisects the earth and passes through both the North and south pole, dividing the earth into eastern and western hemispheres.

Relative location
Description of a geographic point that is dependent on the viewer's location, or on some other location. Example: My school is 4.3 miles south-southeast of here; or, My school is 4.3 miles south-southeast of my house.

Second
The sixtieth part of a minute of angular measure, often represented by the sign ", as in 12° 10' 30", which is read as 12 degrees, 10 minutes, and 30 seconds.

Materials

- Internet access (required)
- Google Earth or similar mapping tool (recommended)*
- Handout worksheet (provided)

** If Google Earth or other mapping tools are not available, the students will need a globe, atlas, or other reference material that they can use to determine what landmasses are at different latitudes. Google Earth is a free download at http://www.google.com/earth/*

References

Orange County Water Atlas

Procedure – Day 1

Engage/Elicit

Begin by posing this problem to the students: you are out in the middle of nowhere (out camping or hiking, for example), but you've been injured and need someone to come and rescue you. How do you tell the rescue party where to find you? There are no road signs, no addresses to give them, so what can you tell them? Let the students discuss this for a few minutes and brainstorm some answers. it is likely that at least a few of them will mention a GPS unit or something very similar.

Ask the students if they have ever looked at a map or seen a GPS device: do they know what all those lines running vertically and horizontally are supposed to be? Have they ever heard of 'map coordinates'? Do they know how to read the coordinates on a map?

Explore

Begin by introducing the students to the concepts of latitude, longitude, and degrees, minutes, and seconds using the worksheet provided below. Once they have defined these terms, again discuss the lines on a map or GPS screen to discover if they have any new ideas or questions.

Next, have the students complete Part 2 of the worksheet. Allow them to explore the Orange County Water Atlas at their own pace; this first class period is devoted entirely to becoming familiar with learning about latitude and longitude and other basic map reading skills. Here are the correct coordinates for the lakes in Part 2:

Lake Name	Latitude	Longitude
Angel Lake	28° 31' 02"	81° 23' 17"
Eagle Lake	28° 44' 15"	81° 37' 18"
Lake Francis	28° 42' 12"	81° 32' 25"
Lake Hill	28° 38' 11"	81° 26' 15"
Lake Ivanhoe	28° 34' 00"	81° 23' 07"
Lake Oliver	28° 22' 10"	81° 38' 51"
Rock Lake	28° 32' 48"	81° 24' 05"
Lake Warren	28° 27' 45"	81° 20' 13"

Once they have completed this worksheet, have the students take a look at a globe, atlas, or a mapping tool like Google Earth. Ask them what, if anything, they notice about the measures of latitude; ideally, someone will notice that the numbers increase as you move north and south of the equator (the closer to 0, the closer you are to the equator). If nobody notices this at first, ask them to find approximate coordinates for certain locations: cities (Orlando, New York City, Havana (Cuba), Toronto (Canada), etc), terrain features (mountains, lakes, rivers, etc). Alternatively, have them work backwards and locate random coordinates that you assign. As they explore with the map, ask them to write a brief summary of what happens to the latitude and longitude as the move around the globe.

Explain

After their exploration on the first day, wrap up by emphasizing that the smaller the latitude's measurement, the closer to the equator a coordinate is going to be. Ask the students what they know about climate near the equator: if they don't know, tell them to think about it and be prepared to discuss it the following day.

Extend

If you have the time and resources, you can combine the coordinate part of the first day's activity with an exercise on topography and bathymetry. As the students locate the lakes, in addition to recording their latitude and longitude, have the students note the size (in acres) and general shape of the lakes (draw a rough sketch). Also check the Orange County Water Atlas to see if that lake has any bathymetry data (a map displaying the depth and contours of the lake bed). Students can begin to develop a deeper appreciation for three-dimensional space, and how the shape of the land can influence the size and shapes of the lakes.

Exchange/Evaluate

Evaluation for the first day is to check the answers on the worksheet. Additional participation points for students that are involved in the discussion and brainstorming can be used, too.

Procedure – Day 2

Engage/Elicit

Begin by posing this problem to the students: if the climate warms too much, we might begin to see some serious changes to our local environment. Melting polar ice caps could cause a significant increase in sea levels (which is a big problem for Florida since we have so many coastlines and there is very little land here that is very high above sea level). Also, increases in temperature could cause more droughts and less rainfall, leading to smaller/fewer inland lakes and bodies of water in the state of Florida. However, it is difficult to imagine exactly what might happen; is there any way to actually *see* what Florida might look like if climate change continues to occur?

Let the students discuss your question and brainstorm ideas about ways we can visualize climate change. If they come up with any interesting ones, you may wish to consider adding them to the extend phase or incorporating them into a later lesson on climate change. If none of the students mention looking at warmer/more southern climates to compare to Florida, remind them of the work they did on Day 1 with longitude and latitude and ask them if there is any way we can use those results to help solve this problem.

Explore

First, ask the students to locate Lake Ivanhoe on the Orange County Water Atlas; they found this lake on Day 1. Once there, ask them what would happen if the water levels of Lake Ivanhoe dropped significantly due to climate change—say, by 10 feet or more. What would happen to the lake? Let them explore the Lake Ivanhoe page on their own and if they do not find their own answers within a few minutes, direct them to look at Lake Ivanhoe's bathymetry map.

They should note that if the lake level drops by 10 feet or more, there will now be three different smaller lakes. What will the longitude and latitude of these new lakes be (the answer is right on the bathymetry map, but it is a good idea to keep reinforcing the importance of the map coordinates)? This concrete, local change can give them a good idea of what might happen if the climate warms and becomes drier: lakes will shrink and/or disappear. What might this mean for local wildlife that depends on the water?

Second, ask the students to try and imagine more large scale changes to the local climate. What else might change beyond lake levels? Give them some time to consider their answers (either by themselves or in small groups) and then have them use Google Earth, a globe, an atlas, or other mapping tool to find a country near the equator. Areas like northern South America, central Africa and southern Pacific Islands like the Philippines are all good places to focus, but leave the final choice up to the students. Once they have selected their country, have them use whatever reference tools are available to determine an approximate location (latitude and longitude) and some basic information about the country's climate (average temperature, average rainfall, most common terrain like

rainforest or grassland or desert, etc). Their goal with this information is to then write a description of what they think Orange County and the state of Florida might look like if the climate continues to change, using their selected country as a frame of reference. In addition to the description, they should include some justification as to why they think their descriptions might be an accurate prediction.

Explain

Direct your students to www.orange.wateratlas.org > Explore > Programs > Climate Change & Florida for further information regarding climate change. Make it clear that while we can't predict the exact effects that climate change might have on Florida, it will result in a shift to our ecosystem and a disruption in what we would consider the normal ecology. Looking at these more southern countries will give us an idea of what we might possible occur here in Florida. Have the students share their ideas and predictions that they wrote and brainstorm other possible changes.

Extend

Building off of the topographic and bathymetric extensions from Day 1, consider designing 3D models from papier mache, clay, play-dough or any other material that allows your students to easily construct hills, lake beds, and other topographical features. After the material has hardened (you'll probably have to wait at least overnight), place the model in a deep tray or pan and slowly add water to the pan. Stop periodically to observe how the water flows over the model and what sorts of terrain features remain above the surface of the water. How does this relate to climate change? Are there any models that are relatively flat (few high terrain features) or relatively high/hilly (a lot of large/high terrain features)? How does the addition of more water change the terrain on these different models? Florida is relatively flat, with much of the peninsular land mass just above sea level; what would this mean for a rise in ocean levels? How would that compare to areas that are further inland where the terrain rises?

Exchange/Evaluate

Collect and grade the students' written predictions for climate change based on other, more southerly locations. You are not looking for "correct" answers (no one can say for certain what exactly will happen if the climate continues to drastically change, though there are many predictions and models), but you do want to see that they have based their responses on information collected from their chosen location and that they can justify and support their answers with this collected evidence.

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