



LESSON PLAN – GPS and H₂O

Learning GPS – Change and Water Mapping
Grades 10-12 – Environmental Science, Earth Science

OVERVIEW

This lesson introduces GPS technology through two participatory activities. These activities are reinforced by group discussions and presentations.

The first activity is an observation and mapping exercise that teaches navigation, GPS, and the effects of climate on the landscape, especially in living systems and waterways.

The second activity uses creative thinking and problem solving to reinforce the lessons learned in the mapping activity. It solidifies students' understanding of the latitude-longitude coordinate system and results in an application to receive a chronofact to geocache.

If the application is approved, the team at FutureCoast will mail a chronofact to the teacher, and a student team will carry out its geocaching.

This lesson engages students with FutureCoast, an open exploration of possible futures. The students play an important role in furthering the creative “cli-fi” fiction of the storymaking game. FutureCoast is live Feb-Mar-April 2014 at FutureCoast.org.

This lesson is designed for two days but could be condensed to require less class time.

LEARNING OBJECTIVES

- Students will learn how global positioning satellites are used to determine the location of points on Earth's surface.
- Students will learn to use a handheld GPS receiver or web-based GPS mapping.
- Students will learn to geocache, gather real world data and problem solve authentic challenges.
- Students will identify and photograph climate-change related areas in their community.
- Students will plot GPS coordinates and photos on a map.

Participating in a geocaching activity helps students understand the features and capability of the Global Positioning System (GPS). They learn how to use GPS units, digital data, and online resources that support these technologies. By gathering and using authentic data, students engage in the scientific process, problemsolve, and collaborate with other learners. This encourages students to be actively challenged while integrating new concepts, working collaboratively and applying their new understandings/skills.



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MATERIALS

- Cameras or cell phone cameras
- Large map of the local community, or projected digital map.
(Optional: additional reference maps or images that show land changes over time)
- Internet access to Google Maps to derive GPS coordinates.
(Optional: GPS receivers or cell phones with app for locating GPS points, one per team).

PRE LESSON PROCEDURE

The teacher will pre-generate a short list of example areas that may look different in the future due to climate change. A local area map that helps students visualize land changes over time, such as a 100-year-flood map or a historical map, can also be useful.

LESSON PLAN DAY ONE

As a class, students will brainstorm local locations that may look different in the future as a result of climate change. This could be a fruit tree with a root depth that may become too shallow to reach the water table or a path in the local park that gets eroded when it rains. As the class suggests locations, the teacher will mark them on the map. Note many of these changes may involve water (much less or much more in the future).

Once the class has generated a good list, the teacher will show how to use Google Maps to get the GPS coordinates of a location.¹ The class will discuss what GPS means, how it works and how it's used. Explain that a fun way GPS is used is 'geocaching' – making a scavenger hunt with hidden objects that other people use GPS to find.

The teacher will then show a picture to introduce the chronofact object and talk about the FutureCoast website. They will share that people all over the country are looking for these chronofacts and ask if the class would like to apply to hide one. Referring to the worksheet, the teacher will talk about good places to place chronofacts: What is 'public' space? What are safe places for people to visit? How hidden should it be? In what ways is the site meaningful when thinking about climate change? (i.e. Is it near water? What plants grow there?)

¹ To find the coordinates of a location in Google Maps:

1. Find the location in Google Maps, and zoom in on the exact spot.
2. Right-click on the spot: a menu will appear. Choose "What's Here?" A green pointer should appear.
3. Click the green pointer on the map, and a panel should appear with numbers on it. Those numbers are the GPS coordinates for that spot.



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HOMework DAY 1

Students, working in small teams or individually, will put together proposals for chronofact locations using the worksheet provided. These will take the form of presentations to the class describing their chosen location including photographs/drawings and reasons why this is the best place for a chronofact.

This activity will require travel outside of school to local public areas (parks, etc.). To accommodate this activity, this may be best assigned over a weekend or multi-day period.

LESSON PROCEDURE DAY TWO

Each student or student team presents their proposed chronofact locations. Mark each on a shared map and discuss the pros and cons of each location with the class. Review for safety, visibility (not too much, not too little), and accessibility as well as the context of the location. Together as a class, decide which location to submit on the chronofact application. As a class, you can review and fill in the application.

The teacher can then apply for a chronofact using the class-generated materials.

EXTENSIONS

Listen to a few voicemails from the future at the FutureCoast website (FutureCoast.org). As a class talk about them. Discuss what each one tells us about the future it is from. Discuss how likely students think this particular future might be. Ask students to consider what makes each voicemail sound authentic (like it really comes from the future).

Now pair students together to script voicemails of their own. Each pair may refer to the curated list of science resources at FutureVoices.net. Or students may choose an existing voicemail and script a response to it – it could be the called person calling back, a call made from the same future, or a similar call made under different circumstances. When deciding what the future in their voicemail will be like, encourage students to think about who is doing the calling, why they are calling, and their relationship to the person they were hoping to reach.

If students are over 13, they may use the FutureCoast hotline to record their voicemails for inclusion on the public website: **(321) 7-FCOAST**. Each student of a pair can rehearse their message with their partner before calling.



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LESSON PROCEDURE – CHRONOFACT GEOCACHING

It will take a few weeks for the application to be processed. If it is approved, a chronofact will be mailed to the applicant, with a geocaching guide. Using the guide, a student team will geocache the chronofact and report their success to FutureCoast. The students can then check the FutureCoast site to find out who located the chronofact and what voicemail from the future it contained.



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A CHRONOFACT



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LINKS TO USEFUL RESOURCES

http://oceanservice.noaa.gov/podcast/supp_may09.html#geodesy
LINK TO PODCAST ON GEODESY

http://store.usgs.gov/b2c_usgs/usgs/maplocator
Free Downloadable/Printable Map

<http://www.nasa.gov/audience/foreducators>
National Aeronautics and Space Administration

<http://oceanservice.noaa.gov/education/>
National Oceanic and Atmospheric Administration

http://climate.nasa.gov/interactives/climate_time_machine
Climate Time Machine

<http://www.pbs.org/wgbh/nova/earth/earth-from-space.html>
Nova's "Earth From Space" uses data from earth observing satellites. Produced in consultation with NASA scientists this space based documentary reveals the web that sustains life on earth.

<http://www.gps.gov>
Official US Government Information on Global Positioning System

<http://www.epa.gov/epahome/school.htm>
United States Environmental Protection Agency

<http://environment.nationalgeographic.com/environment/freshwater>
National Geographic

Resources to spark voicemail ideas at FutureVoices.net



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WORKSHEET

Use your knowledge of your neighborhood, town or city to identify a good spot for a mysterious “artifact from the future” to appear. Criteria:

1. It must be in a public space, such as a park or public plaza.
2. It must be out of anyone’s way, and not hard to get to.
3. You should have a story as to why this spot is significant when viewed over time. You might find out about the history of the spot, or you might imagine its future. You might connect the spot to water or to the people who live nearby, because both often make changes to a landscape. Use your knowledge of the area, “futures thinking” and your imagination when developing your story.
4. Imagine people arriving on the scene and looking for the chronofact. Why will this location be fun for them (not too easy, not too hard)?



Where will you put the chronofact? Take pictures!

(give the address and describe the location)

What are its GPS coordinates?

(i.e., 40.783726, -73.964213 or +40° 47' 1.41", -73° 57' 51.17")

Why is this a good place for a chronofact to appear? (your story)

If your location is selected, FutureCoast will send your teacher a “chronofact” to place in your spot – so make your story a good one!