

Using GPS and GIS

OVERVIEW & OBJECTIVES	GRADES
<p>This is an introductory geography skills lesson that engages students in learning the difference between GPS and GIS. Students use GPS coordinates to discover geocaches at a local park, and they use ArcGIS to layer maps about the park. Frontenac State Park is the example, but any park or area (including school grounds) could be used. Students also investigate careers that use GIS.</p> <p><i>Students will be able to...</i></p> <ul style="list-style-type: none"> • Explain the difference between two types of geospatial technologies—GPS and GIS. • Develop basic skills to effectively manipulate and use GPS receivers and ArcGIS software. • Explain uses of GPS and GIS. 	8 th
	TIME
	3 days
	REQUIRED MATERIALS <ul style="list-style-type: none"> ✓ Computer projector ✓ Computer Internet access for students ✓ Markers and poster paper ✓ *GPS receivers ✓ Handouts: “ArcGIS Activity: Explore Frontenac State Park”; “Activity: Explore Frontenac State Park”; “Geocaching Passport”; “Carousel Brainstorming” ✓ *Geocaching materials: coffee can, stickers, geocaching passport booklet for each group
MINNESOTA SOCIAL STUDIES STANDARDS & BENCHMARKS	
<p>Standard 1. People use geographic representations and geospatial technologies to acquire, process and report information within a spatial context.</p> <p>8.3.1.1.1 Obtain and analyze geographic information from a variety of print and electronic sources to investigate places or answer specific geographic questions; provide rationale for its use.</p> <p>8.3.1.1.2 Create and use various kinds of maps, including overlaying thematic maps, of places in the world; incorporate the “TODALSS” map basics, as well as points, lines and colored areas to display spatial information.</p>	

SUGGESTED PROCEDURE

Preparation

GPS Receivers: Many facilities offer GPS receivers that can be used as well as the ones the school provides. Students may work in larger groups to reduce the number of GPS receivers needed. For novice GPS users: Set up geocaches in a small area, but without the locations being visible, so students will be able to use their geographic skills. Also, you might want to introduce students to the GPS receivers before using them for the first time so they are comfortable and successful with them.

Geocaching Materials: The teacher will need to develop geocaches and locations prior to students’ visit to the park or other location. I used a coffee can with stickers inside to protect and conceal the location while providing accountability for students locating each cache. The geocaching

passport booklet I made displays their stickers as students traveled from one location to the next location.

Day 1:

Students will be given a survey as a pre-assessment, which may be done in print or computer format, to understand students' varying knowledge and ability levels with geospatial technology. The questions include:

- I know the purpose of GPS (Global Positioning Systems)
- I know the purpose of GIS (Geographic Information Systems)
- Geospatial technologies help us better understand and make choices about our world.
- I have used GPS...
- I have used GIS...
- Technology enhances (or makes better) mapping—improves mapping

Introduce the geospatial technologies of GPS and GIS. Ask students: What are geospatial technologies? What is GPS? What is GIS? Students will watch the video clip, “Launchpad: How GPS Works”, to understand GPS—what it is, why it began, how it works, where it is used. Discuss the video.

Students will watch the video clips, “How GIS Works” and “Why study GIS? Geospatial Revolution”, to understand GIS—what it is, how it works, and where it is used. Discuss the videos and the differences between GPS and GIS.

Students will complete the handout, “ArcGIS Activity: Explore Frontenac State Park” to understand how to use GIS software. ArcGIS software should be available on students' iPads or computers. Students will complete the second handout by placing screen shots on the handout, “Activity: Explore Frontenac State Park”, along with a brief explanation of the contour map. This second handout should be accessible to students on their computer.

Day 2:

Students will be going to Frontenac State Park with their GPS receivers and the handout, “Geocaching Passport”, of cached sites as well as a geocaching passport booklet that the teacher created. Students will work with partners or in groups of three to identify the cached sites using their GPS receivers. Students should be placed in heterogeneous groups of experience with GPS, but may need additional direct guidance if unfamiliar with the GPS receivers. They will travel to each of the geocached sites beginning at one of the five sites so students will be spread out. They will affix the discovered sticker from each site to the their group's geocaching passport booklet.

Day 3:

Students will share their experiences at Frontenac State Park through a Think-Pair-Share in which students record highlights of the experience and 3 things they learned, share responses with a partner, and discuss with the class.

The teacher will ask why the geospatial technologies of GPS and GIS are important. Students will read the summaries of the slide show and the article, “GIS (geographic information systems)” from National Geographic Education Encyclopedia. Discuss with students how they have used GPS and GIS in their daily lives including farming, traveling, camping and fishing, and how geospatial technology is connected to their current and future lives.

Students will then participate in a Carousel Brainstorming activity. Students will be placed in groups, each with a different colored marker, and report to one of five posted questions. Students will answer their question before rotating to the other posted questions, adding their response to the others. When completed and returned to their original question, they will report responses to the class. Complete directions are on the handout, “Carousel Brainstorming”.

Carousel questions:

- Identify how you might use GPS now or in the future.
- How could GIS be used at Frontenac State Park?
- What types of data layers could be used in GIS?
- What professions/jobs could use GIS? List them and how GIS could be used.
- What is one academic thing you will remember from our field trip to Frontenac?

Students will read the brief article, “Many Reasons to Consider GIS as a Career”. Students will then watch one of the 6 videos from “GIS Career Videos” (3:30 to 4:15). Students will write a paragraph response based on the following prompt:

Six professionals who use GIS explain how it is used in their daily jobs. Choose the one of most interest to you, watch the short video, and write a one-paragraph response that explains why GIS is important to this career and explain what types of data are gathered and mapped. Use the name of the career you chose as the title of the paragraph. Submit the paragraph on Schoology.

Students will be given a survey as a post-assessment, which may be done in print or computer format, to understand students’ varying knowledge and ability levels with geospatial technology after this lesson. The questions include:

- I know the purpose of GPS (Global Positioning Systems)
- I know the purpose of GIS (Geographic Information Systems)
- Geospatial technologies help us better understand and make choices about our world
- Technology enhances (or makes better) mapping—improves mapping
- I understand the basics of creating maps with ArcGIS software and using GPS receivers
- I can think of uses for both GPS and GIS in my world and in future careers

Assessment

Pre- and post-assessments

“Activity: Explore Frontenac State Park” handout

Career video paragraph

Website Resources

ArcGIS at ESRI

<https://www.arcgis.com/features/>

“Launchpad: How GPS Works” (4:10) from NASAeClips at You Tube

https://www.youtube.com/watch?v=DsmvTzw3GP4&list=PLD7BEC5371B22BDD9&index=66&feature=plpp_video

“How GIS Works” (3:46) at ESRI

<http://www.esri.com/what-is-gis/howgisworks>

“Why Study GIS? Geospatial Revolution” (1:00) at PBS

<http://www.pbslearningmedia.org/resource/psu10sci.vid.geospatial.whystudy/why-study-gis-geospatial-revolution/>

“GIS (geographic information systems)” at National Geographic Education Encyclopedia

<http://education.nationalgeographic.org/encyclopedia/geographic-information-system-gis/>

“Many Reasons to Consider GIS as a Career” at ESRI

<http://www.esri.com/news/arcuser/0311/many-reasons-to-consider-gis-as-a-career.html>

“GIS Career Videos” at ESRI

<http://edcommunity.esri.com/Careers/career-videos>

ArcGIS Activity: Explore Frontenac State Park

Directions: Follow each direction step by step.

1. Go to <http://www.arcgis.com> and click the three bars in the top left corner
2. Click "Map"
3. Click "Basemap" and choose "Imagery with Labels"
4. In the search bar, type "Frontenac State Park" and choose the FIRST option
5. Zoom in to Frontenac State Park until the scale bar represents 2 MILES LONG
6. Click "Modify Map" in the top right
7. Click "Add" in the top left, then choose "Search for Layers"
8. In "find:" type "Minnesota State Parks," click *go*, then choose "add" for the first layer option
9. Keep that layer up, but go back to "find:" and type "tree cover" and click "go"
10. Scroll down until you see "Tree cover (2000, Hansen/UMD/Goo)". Click "add" to put this layer on your map
11. On the bottom left, click "Done Adding Layers"
12. Click "Details" on the top left to collapse the sidebar

Take a screenshot (click the home button and the lock button at the same time) and post it in our "ArcGIS Frontenac Exploration" file on Notability for #1.

13. Click "Details" on the top left to expand the sidebar
14. Re-type "Frontenac State Park" in the search bar and click the FIRST option. Zoom in or out until the scale bar represents 0.2 MILES. Position your map so you can see the park entrance (where the point on the box is) at the bottom of your screen with Lake Pepin on the top
15. Under "Contents", click on the "Minnesota State Parks" layer, and then click the THREE BLUE DOTS
16. Click "Transparency" and practice moving the bar from 0% to 100%. Note what happens. Set it at 75%
17. Click on the "Tree cover" layer. Click on the three blue dots and then "transparency". Set it to 75% as well
18. On the top grey bar, click on the 4 boxes in a square shape. Change the basemap to "Topographic"

Take a screenshot (click the home button and the lock button at the same time) and post it in our file for #2.

Answer question #3 with written or typed text using the map you've created.

Activity: Explore Frontenac State Park

1. Please paste or insert the screenshot you took of your map from steps 1-12.

2. Please paste or insert the screenshot you took of your map from steps 13-18.

3. Using the map you've created...

Remember, on a contour map the closer the contour lines the steeper the elevation. Based on your map, would you say that the heavier tree cover is found on steeper or flatter land in Frontenac State Park? Explain your answer in a few complete sentences.

Geocaching Passport

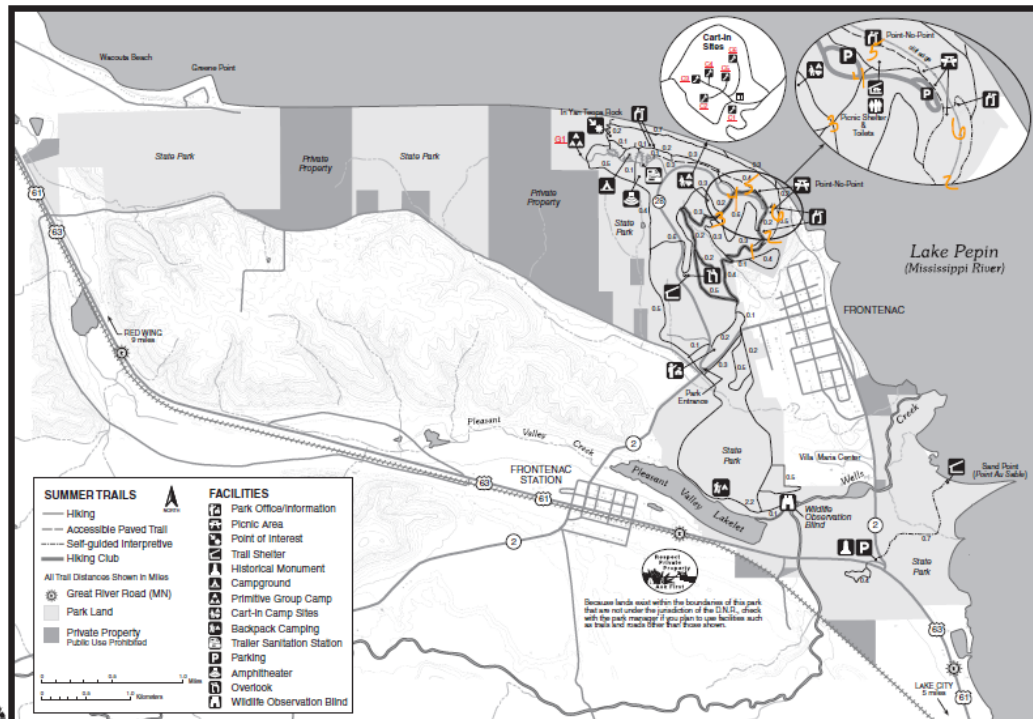
Clues and coordinates! You will go to your assigned starting point using the clue and coordinates provided. When you find the cache (coffee can), take ONE sticker per group, and put on your passport. Then, take a picture of the Cambrian creature and the surroundings of your cache. Next, proceed numerically to the next cache using the clues and coordinates. You will move in a clockwise circle in the area mentioned during the directions. When you have found all 5 caches, return to our meeting location. If after 25 minutes you have not found all caches, you need to get back to our meeting location.

1. At some trees by the most majestic scenic overlook in the park. N44.32.051, W092.20.141
2. At a northern portion of a loop in the trail. N44.32.115, W092.20.296
3. At the junction of four trails (the crossing of two trails). N44.32.061, W092.20.474
4. At a cart-in parking lot. N44.32.168, W092.20.395
5. At a spot just off the trail and just past a shelter. N44.32.201, W092.20.299

FRONTENAC STATE PARK

SUMMER FACILITIES AND FEATURES

- 58 site semi-modern campground/19 with electricity
- 6 rustic, all-season cart-in campsites
- 2 backpack campsites
- Dump station, showers, and flush toilets (seasonal)
- Primitive group camp with running water. Capacity 35 (seasonal)
- 40 site picnic ground with enclosed shelter/trail center with wood stove and electricity. Seasonal modern restrooms.
- 14.2 miles of hiking trail
- 1 mile paved ADA multi-use trail.



Carousel Brainstorming

Carousel Brainstorming is a Best Practice strategy to enhance your learning. As a group, select a colored marker, go to any posted newsprint, read the question, and record responses as you brainstorm answers. After 2-3 minutes rotate clockwise to the next posted question and, after reading previous responses, brainstorm additional answers. Continue rotating clockwise until you have been at each posted question. When you return to the original question, categorize the responses and write a summary at the bottom to answer the question. Be prepared to present the summary to the entire group. The following summary of Carousel Brainstorming provides further details of this valuable activity.

Carousel Brainstorming

Carousel brainstorming is a strategy to actively engage students in addressing major concepts or questions in groups by identifying their prior knowledge or reviewing and/or evaluating their learning. There are several steps for this activity.

1. Post newsprint paper (3-8 sheets depending on the task and size of the class) around the room, each with a different question related to the topic.
2. Students are placed in groups of 3-5 persons with each group having a different colored marker to record their responses.
3. Roles may be assigned including recorder, timekeeper, facilitator, and encourager
4. Each group goes to a posted paper and brainstorms responses to the question or topic and records their responses using their colored marker.
5. After two to five minutes a signal is given and each group rotates to the next posted newsprint to brainstorm responses to the question or topic using their original colored marker. The colored marker shows the group's progress and assists accountability.
6. As each group rotates, they read previous responses and add their own responses. (They may also "star" previous statements with which they agree.) Each group continues to rotate until it has responded to each posted question.
7. When the groups return to their original question or topic, they should review the posted responses. Next, each group categorizes the responses in order to summarize them to the entire group. Alternatively, the original group may be asked to:
 - Write a summary in exactly 5 words
 - Write a one-sentence summary
 - Identify the potential impact of the responses to the question or topic
 - Identify resources that may be helpful to investigate the question or topic further
 - Share personal experiences or reaction to the question or topic