

GPS Activities

Here are GPS activities you can do in South Dakota State Parks, on the road, or at home. Global Positioning System (GPS) receivers excite young people and adults as well. Take this natural motivator and use it to have some fun with your family and friends throughout the year.

1. “Trust em, but don’t tempt em:”

Many students in South Dakota have had an exposure to GPS in school. If you are one of the many people who have a GPS unit sitting on a shelf at home because you just don’t understand it, ask your kids! Not only is there a chance they may have used them in school, adults must admit that children are natural techno-wizards! They have grown up with technology and are not afraid of it. The first activity we recommend with young people is to give them the GPS (Trust em’), set some physical boundaries (but don’t tempt em’), then send them outside to explore with it. State Parks are a marvelous place to do this.

2. Mark & Find:

A small group can be taught to “mark” and “find” waypoints in just a few minutes.

- Clear all waypoints from GPS memory before class. Hand out of GPS units. Don’t turn the GPS units on until you are outside, under an open sky. Explain briefly how the GPS unit acquires satellites using the satellite screen on the GPS unit. When the GPS unit has acquired at least four satellites:
- Show the group how to mark a waypoint. Keep it simple! (Press the mark button then press enter).
- Select a spot about 200 yards away and send the whole group to that point. While they are walking (kids will run, which is cool because they can check their speed on the GPS while they run). Have the group look at their trip computer screen while walking to see how the GPS tracks data about the user.
- Again mark a waypoint for this second point.
- Now show the group how to use the “find” or “GoTo” button to display the waypoints in the GPS. Each person with a GPS should “find” and select the waypoint they marked at the first spot. Page to the compass page and follow the compass arrow back to the original spot.
- Note the distance going down as you head toward the first point you marked. As your distance get closer and closer to zero start looking around for the spot you marked. See how close the GPS will take you to the same spot. REMEMBER: GPS units report an approximate position only. If you are within fifteen feet of the spot you want, that is pretty close for sport grade GPS.
- Now try and “find” or “GoTo” the other point you marked. If this works for you then you are ready to do simple GPS navigation.

3. How many satellites?

Here is a simple, effective demonstration to help visitors visualize the way GPS satellites work together to locate one point on the Earth. All you need are four pieces of string and

a group with some volunteers in it. The first volunteer takes the end of one piece of string. You tell them that they are a GPS satellite orbiting Earth 12,000 miles in space. You as the demonstrator are the GPS. Run around the first satellite volunteer while asking the rest the group if that one satellite tells where the GPS is? No, one satellite says the GPS can be any place on a 12,000 mile sphere around that satellite. Now take a second volunteer, tie your end of both strings together. Move your end of the strings back and forth while the two volunteer satellites hold their ends tight. This will point out that two satellites locate the GPS somewhere along the intersection of two 12000 mile circles. This is till not enough information to locate the GPS. Using a third volunteer for a third satellite, tie your end of the third string to the other two. Now have all three satellites pull their strings in opposite directions. This will snap the three tied strings tight, showing that all three intersect at one location. Grab this knot and ask the group if three satellites locate the GPS at one point on the planet? The answer should be yes, with just a bit of hesitation. Lift the knot of strings up-and-down. Point out the group that yes, three satellites gives you X and Y coordinates, but not elevation. These X and Y coordinates are also called latitude and longitude. Tie a fourth string to the knot. Have another volunteer pull this string down toward the floor. This time when you ask the group how many satellites are required to get a good navigation fix they'll shout back FOUR, which is true! When your GPS finds four satellites it can tell latitude, longitude and elevation for any point on the planet. More satellites get you closer yet.

4. "Nail" Biter GPS Trail

This is a zero prep activity for small or large groups. Two people can play against each other. 20 people can play as two groups of 10, etc. Most groups will complete the activity within 40 minutes.

You will need:

- At least 2 handheld GPS units, one per group
- 10 small stakes or nails. Tie a small piece of ribbon to each.
- Instructions for using the GPS if you are not familiar with the unit.
- Step by step directions to "nail" down this challenge.
- Divide into 2 groups. Each group should have the same number of GPS units.
- Meet at a designated starting point.
- Turn the GPS on. Make sure the GPS locks on at least 4 satellites.
- Check your battery level. If it is less than 1/4, change batteries.
- Review with how to MARK and Find or GoTo waypoints
- Clear memory in your GPS before beginning
- Each group gets 5 stakes
- You will have 20 MINUTES to hide and mark all 5 stakes.
- First group goes to an area directed by staff. The second group goes to a separate area (opposite sides of a building works well - out of sight of each other).
- Each group hides its nails one at a time. Be creative here. Don't make it too easy! Hide each nail as far apart from the other nails as possible. The ribbons on each nail MUST be visible from 5 feet away, but you can still camouflage them in a bush, or stick it in the crook of a tree, etc.
- Carefully hold each GPS over the hidden nail and MARK that spot. Be sure and save the marked waypoint for each nail on each GPS!

- Repeat for all five nails.
- When you have hidden, MARKed and Saved the location of each nail on each GPS, return to the starting point.
- The two groups then trade GPS units.
- Review with the groups how to FIND or GO TO, SELECT a WAYPOINT, and navigate to that spot. Note: You must “move” before the GPS will give you an accurate direction of travel. START WALKING, THEN LOOK AT THE GPS!
- Most people like to navigate using the COMPASS page. Press the PAGE or NAV button till you get to this page. Follow the dark arrow on the compass dial and count down the distance. When you get within 15 feet of your destination, start looking around!
- Each group goes back out to the area where the other group hid their nails and follows the FIND or GoTo on the GPS to find the hidden nails one at a time.
- Pick up each nail as the group finds it (Hint: “Respect our Parks.” How about picking up “other” litter as you search for nails?)
- When all the nails your group can find have been picked up, return to the starting point. Report to the staff at the start how the “nail biting” search went.
- Turn in your GPS and recovered nails, and you are done!

This activity can really help you “nail down” GPS navigation

5, 6, 7, 8. Scavenger hunts (see below)

These classic GPS activities focus attention on a task that inadvertently involves a great deal of learning. Each activity stands alone. Specific points for each “hunt” must be selected and input to the GPS by the instructor. While easy to do, you MUST learn how your particular GPS operates FIRST! Prep time is all up front. Student success is simple to measure because the “hunt” cannot be completed unless the equipment is used correctly. Patience with many questions is a must! The three activities detailed below are barely the tip of the iceberg. Refer to the Web Guide included for excellent sites to learn theory and application of GPS and on to GIS.

5. Puzzle-Points:

The “point” is to complete the puzzle by having each GPS team (Team organization is up to you) find each of 6 – 10 geographic coordinate sites, pick up a puzzle piece at each site, and combine them when they get to “Home” base. Puzzles could be selected from a children’s jig-saw puzzle with the number of puzzle pieces equal to the number of GPS teams times the number of waypoints (hardest). Or use a children’s puzzle for each GPS team and have the number of pieces match the number of waypoints in the course. Or use Lego or Duplo or Connex figures made out of the same number of pieces as the number of waypoints. Have enough pieces at each point on the course so every team gets one. Instructor previews the area of the course, marks waypoints as wanted, saves as waypoint list or saves to route. Route can be uploaded to GPS units or students can hand enter (I prefer this if time permits). This is a great activity to turn any age student loose on even when they have no experience. THEY WILL FIGURE IT OUT QUICKLY! With waypoints entered and route active, students begin together but do not have to go to waypoints in order.

They will quickly learn this, but you can speed things up by reminding them they can select any waypoint to “Find” or “Goto.”

Use as big a field as you can find. The size of four football fields with dips and depressions to hide puzzle piece containers in is usually minimum for a class size group (25). This takes about ½ hour to 45 minutes usually for student groups to complete. Set up and waypoint entry (and GPS instruction) is extra. The favorite containers for puzzle parts are small ammo cans. They are waterproof, tough, and if you want to make them more permanent, you can chain them in place.

6. Geo-Blitz

Here is an intense variation on hiding puzzle pieces. This is a wonderful, portable, guaranteed activity that can handle lots of people at once, discourage cheating, take people over a huge geographic area. This is high prep activity though. Recommend that you contact Kelly at rjklane@rushmore.com for help and direction with this activity.

Sample Student task for geoblitz:

Find each of 12 geocaches we have hidden around these fields. DON'T follow another group to a cache. There are 4 different geocache courses and they will probably lead you to the wrong cache. Your group should sign and date the log book at each cache, then collect a puzzle piece from each geocache can. Bring all 12 puzzle pieces of the same color back to the start and assemble them into a complete story. To find the geocaches we will give your group several handheld GPS units with all 12 locations marked. Give prizes for completing the course and bringing in all 12 puzzle pieces correctly assembled.

When Geo-Blitz is set up on a full section of land several hours must be allowed for each group. If you have the GPS units, 100 people can easily be on the course at once. Puzzle pieces could easily be key park features. This is great for community reunions, Centennial celebrations, and major festivals!

An interesting variation for groups that feel like they know what they are doing and want a bigger challenge: Have the first group hide the cans with clues/puzzle pieces. They give their GPS to the next group out who go find the cans. Groups can alternate hiding cans/ finding cans as long as they want to. This variation is a lot less prep for leaders but it also presumes a lot of familiarity with both GPS and moving waypoints back and forth between GPS and GIS.

7. Geo-Riddle Quest

This is a favorite. It takes some creative set-up, but the fun is worth it. AND in the State Parks this can be a permanent geo-riddle quest based on unique park features. There are NO permanent markers to be vandalized or maintained. Spend some time putting a couple of these together in your park that are each based around a unique park resource or set of features. The objective (using GPS and the hand-in worksheet that staff prepares) is to match a list of waypoints, taken at various sneaky locations in the area you choose, to a list of misleading clues. Example: a waypoint at a GLOBE weather station box. Students get the waypoint on their GPS units and have to match

the waypoint number to the written clue, “I stand white side up in an ocean of green.” The waypoint for the newspaper delivery tube must be matched against, “My insides are black and white and red/read all over. On the football field there are a wealth of stealthy clues, including, “40 south by 15 north” (far hash mark on the 10 yard line), “You turn me off and on so quickly during games that I am sometimes stricken dumb” (P/A speaker). The ultimate misdirection is to pick a common spot, name it in the clue and say that the waypoint is, for example, “200 yards at 160 degrees from that spot. Students have to be able to enter bearing and distance, press enter, and go to the new waypoint. (Caution” this is impossible till you figure it out. Easy IF you can figure it out). Remember, students have the waypoints uploaded into the GPS in hand, along with the entire list of clues, so the clues have to be obscure. A great way to learn a lot by having fun!

Depending on the obscurity of your clues this activity takes 45 minutes to several hours. You can keep the numbered waypoint list in a route and upload it to the GPS units.

8. Virtual Orienteering

If you have any familiarity with the exciting sport of orienteering, how about a virtual point-to-point orienteering course? In a big natural area or park, select twelve points marked and saved as a route on the GPS. Points should be fairly well hidden because each point has a geometric symbol displayed. On each symbol is written the number of the symbol plus the distance and bearing to TWO other points (IT IS MUCH EASIER, BUT MORE PRONE TO ‘FOLLOW YOUR NEIGHBOR” TO PUT JUST ONE DISTANCE/BEARING PAIR ON EACH SYMBOL). Each student GPS team gets a different bearing and distance to begin with. From there they find the others on their own.

Orienteering is fun to venture into because it makes competitive use of compass and topographic maps in other formats. Physical Education teachers often will join in designing a course because the real competitive goal is to be the first one back with all symbols copied correctly and listed in the correct order. City parks are most commonly used for point to point competition. There is a wealth of info available on the web or in print. A favorite reference still is Bjorn Kjelstrom’s Fun with Map and Compass. Your concrete assessment, again, is the list of symbols matched to the correct number (standard symbols are listed in Kjelstrom’s book).

9. Point Array

You may remember the old compass courses we used to set up for teaching compass skills with stakes set out in an array. Take 20 stakes, (number or mark each stake in a unique way) and set them out in a circle. You will need several football field sized area for this. Plan your circle (or you could just make a square grid of stakes) so there is at least 100 feet between each stake. Carefully mark the waypoint location for each stake. Load the waypoints for 5 stakes into a GPS. Hand load five more into a different GPS, etc. You will end up with 4 GPS courses in a relatively small area where participants will have to navigate very accurately to find their 5 stakes. “Follow the leader” is discouraged because there are 4 different courses going on at the same time. A great variation on this

game is to do it with 6 or 7 decimal places of accuracy on the GPS, then cut the decimals down to 4 or 5 and watch the confusion.

10. GPS Geometry

Plot the outline of your school building by taking a waypoint at each corner. Figure the area of the building or identify various geometric shapes in the outline.

11. GPS Map

Send students on bus routes with a GPS, then download and map the track data over an aerial photograph of the district. Give map to transportation coordinator.

12. “Prove it”

Find and mark the “drug free zone” signs around your school. Are they where they are supposed to be?

13. Data Analysis: “Why did they do that?”

Have each student take a GPS unit and a digital camera home to mark their house and photograph it. Download the waypoints onto an aerial photograph of your town and link the photographs to the waypoints for a virtual home tour of your class. Add several other categories of data to the table you create for this project (i.e. waypoints for fast food restaurants). Map the new data and compare it to student homes, or map school locations and compare fast food restaurant location to schools (bet you will be surprised at the relationship between the two). Take some of this interesting analysis to your local government and ask them why it is like this. Study marketing theory to answer the questions yourself.

14. Design Sense

Follow school maintenance staff around and mark mechanical and emergency equipment as well as emergency exits for your school. Overlay these on an aerial photograph of your school. Maintenance and emergency personnel will hug you!

15. Natural resource management

Develop a virtual nature hike. Participants find featured points on a trail brochure by going to points on a GPS unit rather than trying to find trail markers that get damage, lost or taken. This also does not make the location of sensitive park features obvious to casual passersby who might accidentally “collect” the feature because it is marked.

16. Environmental Cents

Drive or walk your fields with a GPS, then download field boundaries to a map. Now check the fields during green-up on your 4-wheeler and mark any dry spots, thin spots, or other problems. Save the points as a route.

17. Behavior Study

Fit your GPS into a collar for a cow. After a day of grazing, download the track. Where and what did your cow like to graze on?

18. Geocaching

Go geocaching! SD has fewer geocache sites than many other states, but more are added almost every week. Find sites by going to www.Geocaching.com. **GeoGames**: Check out the Web guide for other GPS activities like geo-draw, geo-golf, geo-games.

19. Research Design

Design a research question that GPS data can answer. This is a great tool for Geography or History contests and Science Fairs.

20. GeoEthics, GeoImpact

Literature and media provide many examples. Classic literature like George Orwell's 1984 and Ayn Rand's Anthem discussed the subject two generations ago. More recently movies like Enemy of the State with Will Smith point out some of the very real GPS-based electronic surveillance possibilities already in existence. Stimulating discussions can easily be held in any classroom on the ethics of surveillance, the legality of tracking people with GPS-like systems, and the impact this will have on a free state. What will be the impact of global surveillance on scientific sharing and research and development among competing nations? Advanced mathematics could be included in discussions on satellite tracking and celestial navigation. The nature and history of science is woven throughout the development, deployment and modernization of the GPS system. And, what comes next?