Friends of Sierra Rock Art * SITE MONITORING WITH A RECREATIONAL GRADE GPS *

Bill Drake v10/20 (The Forest Service's highly accurate Trimble professional GPS is only occasionally available to us)

ACCURACY

The first thing to keep in mind when using your own "recreational grade" (ie, non-professional) GPS is that its readings are approximate. Garmin notes on their website, "Garmin® GPS receivers are accurate to within 15 meters (49 feet) 95% of the time. Generally, users will see accuracy within 5 to 10 meters (16 to 33 feet) under normal conditions." (*Some GPSs have a "waypoint averaging" feature allowing for greater accuracy.*)They also note, "Certain atmospheric factors and other sources (tall buildings, densely populated areas, etc.) of error can affect the accuracy of GPS receivers."

You GPS should have a "satellite" page you can refer to, which allows you to see what satellites you are getting input from, what the strength of their input is, and the estimated accuracy at that moment. If the device is not accurate enough, you can watch that page for awhile to see if it improves as satellite input improves. For example, over a few moments, the accuracy may go from within "18 feet" to within "9 feet" (or less) at which point you might record your position or take some other action.

If you are using a USGS topo map (or a map from Garmin or another GPS map distributer), keep in mind that it can be inaccurate to a small degree as well.

MAP DATUM

From *Wilderness Navigation*, Burns & Burns: "A datum is a point of reference used by mapmakers, surveyors, and GPS device manufacturers, upon which to base position coordinates." From *Basic Illustrated: Using GPS*, Grubbs: "A datum is a model of the earth's surface based on a surveyed network of physical points." From *The GPS Handbook*, Egbert & King: "Early datums assumed the earth was a perfect sphere, but modern satellite measurements have produced much more accurate datums."

<u>If your GPS datum does not match the datum for the map that is being used, your coordinates can be a mile or more off.</u> Old USGS maps and old USFS site records relied on the NAD 27 CONUS datum (North American Datum of 1927) but that datum has generally been replaced by the more accurate NAD 83 (North American Datum of 1983). WGS 84 (World Geodetic System of 1984) is often used as a default datum by GPS systems. Its coordinates are usually within a meter or two of NAD 83 in the continental U.S. The same coordinates for NAD 83 (/WGS 84) and NAD 27 can have a difference of as much as 200 meters. A USGS map's information section will tell what datum is relevant. Unfortunately, many sources on the internet give you coordinates but not the datum.

<u>For the USFS be sure and set your GPS's datum for NAD 83 and note your use of that datum when you put coordinates in your site report. Keep in mind that old USFS site records will have used NAD 27. Your site record may not tell you which was relied on.</u>

Once when I adopted a new site to monitor, in my first monitoring report I noted that the site record's coordinates for the site datum were 100-200 meters off. What I found out later was that the old report was relying on NAD 27 and I was using the current USFS datum of NAD 83.

Note: You can use your GPS or Garmin computer map program (BaseCamp) to convert coordinates made with one map datum to coordinates for another datum by changing the datum used by the GPS or map program.

(Reference: https://www.maptools.com/tutorials/map_datum)

UTM OR UNIVERSAL TRANSVERSE MERCATOR VS LATITUDE/LONGITUDE; USFS & METRIC SYSTEM

Different systems are used to assign coordinates to locations on the earth's surface. Latitude/Longitude is based on degrees, minutes (fractions of a degree), and seconds (fractions of a minute). The UTM system divides the earth into zones and uses meters as its unit of measurement. **The USFS uses UTMs for coordinates and all measurements are done with the metric system (ie, meters, centimeters).**

USING A GPS TO MARK A LOCATION

If you have a GPS, you will know, or quickly learn, how to "mark" a location or "waypoint," and access your collection of waypoints on the GPS. If you find a petroglyph panel, feature, or artifact that is not in your site report, you will "mark" it's location on your GPS so you can add its coordinates to your report, noting that you used a recreational GPS to get the information. You can also "mark" all the site's features, panels, etc., as you find them the first time so you can easily locate them on future visits. *(NOTE: Remember, site locations are kept confidential and any coordinates on the GPS that locate a site should be deleted when not needed. Be very careful with site coordinates.)*

INPUT A COORDINATE INTO YOUR GPS SO YOU CAN FIND ITS LOCATION

To use a GPS to find a site you have the coordinates for (from the site record), you need to enter them into the GPS. One way to do this is to "mark" or make a new "waypoint," and then switch to the editing field for the waypoint and change its coordinates to the site's coordinates. Then you can use the GPS' "go to" feature to find the location. With Garmin you can also put the coordinates in BaseCamp and transfer them from there to the GPS. (*See "NOTE" in previous entry*.)

MEASURING DISTANCE WITH YOUR GPS (AND DETERMINING APPROXIMATE COMPASS DIRECTION)

You can use the GPS to measure distance, for example from the site datum to a new petroglyph panel you found, but keep in mind that the results will be approximate and may be less accurate than pacing or walking the distance. To measure distance, in this example, stand at the datum and mark the waypoint or location on the GPS, then stand at the panel and bring up the waypoint for the datum and your GPS should tell you how far away it is. Most likely, the closer it is, the less accurate the reading will be. With my satellite page noting an accuracy of within about 2 ½ meters, I did three tests over a 30 meter distance. Test 1 yielded 28.95 meters, test 2 - 30.17 meters; and test 3 – 28.04 meters. That is not too bad. Theoretically, if each of your readings are as much as, for example, 2 ½ meters off, with the GPS reading both where the datum is and where the panel is, you could be as much as 5 meters off altogether. If you use your GPS as opposed to pacing for distance measurement, be sure and note that in your report. (The GPS also gives you the approximate direction to the object, which you can record, but an orienting compass would be more accurate.)

ADDITIONAL NOTES

"Go To" feature vs following a "track" - A challenge with telling your GPS to "go to" a location for which it has coordinates is that as satellite input fluctuates, the direction you are told to go fluctuates some, making this type of navigation challenging, but it works. When I am following a previously recorded "track" to a location I have been to, while my location shown on the GPS's track line are a little approximate due to satellite fluctuation, the results are pretty good. (A GPS can help in telling you distance and direction in relation to a coordinate you are trying to reach.)

Compass – if your GPS has a compass, that can be used to navigate to a location, but again, the bearing will fluctuate some as satellite input fluctuates. Be sure the compass is "calibrated."

Map – It is invaluable to have a map in your GPS that shows you your location and surroundings.

Extra Batteries – Be sure and have these on hand.

An "Orienting Compass" – A good compass can be used instead of, or in addition to, a GPS. In some cases this will result in more accurate work. (**See separate FSRA handout "Site Monitoring Compass Procedures."**)

Good Books on GPS Use - *Wilderness GPS*, Bob Burns & Mike Burns c2013, 2nd ed. (150pp); *Basic Illustrated: Using GPS ("A Falcon Guide")*, Bruce Grubbs c2014, 3rd ed. (85pp)