



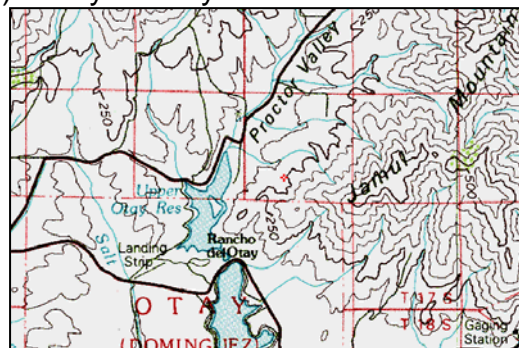
Understanding Maps, GPS, and Coordinate Systems

Understanding a few simple facts about maps, GPS, and coordinate systems will be helpful to you in your tasks as a parobotanist. This handout is designed to answer some basic questions that may arise as you begin to collect your plants and field data.

Maps

Your grid square handout packet contained several maps designed to help you plan your fieldwork safely and effectively. Use your topographic map to record your collecting locations, and use it along with the vegetation, soils, and ownership maps we provided to help you sort out areas of different terrain and vegetation that you should be being visiting.

- A **topographic map** is one that shows features such as relief (mountains and valleys), water and drainage features (streams, marshes, and lakes), and manmade features (roads, bridges, airports and railways). They usually include contour lines to help you find elevation. You may be familiar with “Quad Maps”, which are more officially known as USGS (U.S. Geological Survey) 7.5 minute quadrangle maps (there is a set of about 23 of these that cover our county in detail). Computer programs on CD ROM (like *National Geographic’s* TOPO!) are available for sale and websites like Topozone (see below) are based on USGS maps.
- A **vegetation map** shows the distribution of different vegetation classes (e.g., chaparral, coastal sage scrub, oak woodland, riparian scrub etc.). There are several different schemes for classifying vegetation that are used in California (e.g., Holland codes, CNPS series) but we don’t have a preference.
- A **soil map** shows the location of different soil types. The soil map we provided to you was limited to showing only “sensitive soils” (those which are known to support specialized plant species so you can go visit those areas). San Diego County has an official Soil Survey that was published by the Soil Conservation Service in 1979 (available in the SDNHM library). It uses a nationally standardized system for classifying soil types, and shows all of them on a complete set of USGS 7.5 minute quad maps (but you don’t need to record that level of detail for this project).



GPS (Global Positioning System)

- GPS is a satellite-based navigation system made up of a network of satellites that orbit the Earth twice a day and transmit information. For North America, there is a “constellation” of about 24 navigation satellites (called NAVSTAR) orbiting the earth that is maintained by the U.S. military. Your hand-held GPS unit picks up radio transmissions sent out by these satellites and uses them to triangulate a position on the ground.

- Differential GPS (aka “WAAS-enabled”) is a feature available on some GPS units that uses ground stations on the Earth along with the satellites in orbit to calculate a position. Knowing the difference between the position of the ground stations and the satellites allows a correction factor to be used to calculate a more accurate position for the roving GPS unit (improving the accuracy of readings from about 50 feet to within 10 to 16 feet of the actual location).
- If you have a GPS unit, you'll be able to make use of it for this project. However, this will not be necessary, as we have developed a customized link to “Topozone” (a website where coordinates for your collecting sites can be easily determined for any grid square). You will find a link to Topozone on our website, with instructions how to use it properly to determine the correct latitude and longitude.
- **Please set your GPS** to conform to the format we have adopted for our project (i.e., set the “coordinate datum” for WGS84/NAD 83 and set the “coordinate format” to either decimal degrees or degrees, minutes, seconds). We do not use NAD 27 nor do we use UTM coordinates.

Coordinate Datum

- A map datum is a correction required because the Earth is not perfectly round. We need to know something about the datum because the exact same location will have more than one set of coordinates depending on what datum you are using (just like you can report the time as 1:30 pm or 13:30 hrs depending on whether you are using the 24-hour clock or not).
- We use NAD 83 (or WGS 84) for our project so you must be sure your GPS is set to this option and/or you must be sure any map you use to determine lat/long is also using this datum and not NAD 27 (look at the legend of your topo map to be sure). To help you, we include in your handout packet a color topo map showing your grid square boundaries. It is printed using NAD 83/WGS 84 and it has tickmarks around the border of the map that show latitude and longitude.
- In case you wondered, NAD stands for “North American Datum” and NAD 27 was developed in 1927 and is the standard used to define latitude and longitude on USGS maps (like quad maps). With the help of modern computers and satellites, a more precise standard was developed in 1983 (called NAD 83) and a world standard (called WGS 84) is now in use.

Coordinate Format

There are several formats used for recording coordinates, including the following:

- Latitude/Longitude - Humans have drawn on the Earth imaginary sets of lines that run parallel to the equator (latitude) and from the North to the South Pole (longitude). We can use the intersection of the lines of latitude and longitude to describe where we are on the Earth. To increase precision, each degree of longitude and latitude is divided into 60 minutes (') and each minute into 60 seconds ("). Besides the more familiar “degrees, minutes, seconds” (D/M/S) format, coordinates can be reported in “decimal degrees” (DD.DDDD) that presents the minutes and seconds as a fraction of one degree. Note: the plant atlas project does not use the less common “hybrid system” (DD MM.MM) that uses degrees, and minutes but reports seconds as a fraction of one minute.

- **UTM (Universal Transverse Mercator)** – This world-wide mapping system creates 60 zones around the world (we are in Zone 11). Locations are reported in meters as “eastings” (measured from the central meridian) and “northings” (measured from the equator) instead of latitude and longitude. Note: we do not use this coordinate system for the plant atlas project.

Our online data entry form accepts either degrees, minutes, seconds (D/M/S) or decimal degrees (DD.DDDD) so you can use whichever you prefer. If you use the coordinate finding tool on our website (Topozone) you can select your preferred format by clicking on the appropriate button on the left of the screen and then selecting “Update Map” to refresh the map.

In the table below, the same point location is presented four ways, each representing a different coordinate format. (*Note that decimal degrees is not just D/M/S with a decimal place added after the minutes so do not try to “convert” one to the other simply by adding or deleting a decimal point.*)

Coordinate Systems	Abbreviation	Example of the same point location
Decimal degrees	DD.DDDD	32.8303° N 116.7762° W
Degrees/minutes/seconds	D/M/S	32° 49' 49" N 116° 46' 34" W
Hybrid	DD MM.MM	32° 49.818' N 116° 46.574' W
Universal Transverse Mercator	UTM	520944 meters E 3632496 meters N

Elevation

You can estimate elevation by reading the “contour lines” that are drawn on any topographic map. Contours are lines that connect points of equal elevation and help describe the shape of the land. Be sure to look carefully at your map’s legend to see what units (feet or meters) and increments (20 ft, 40 ft, or other) were used to draw the contour lines. For example, 7.5 minute USGS quadrangle maps (the 1:24,000 scale series) use feet and show contours in increments of 40 feet but the 30x60 minute USGS maps (the 1:100,000 scale series) are metric and show elevation in meters (using 50-m contours). If you plan to use a GPS unit to estimate the elevation of your collecting location, be aware that the error associated with elevation when using a GPS is one and one-half times the error associated with location. This means that GPS readings for elevation are routinely 100 feet off, and one time in twenty they are completely nonsensical.

For more detailed information about recording latitude and longitude, recording elevation, or to find out what settings to use on your GPS unit, please refer to the page of FAQs on our website at www.sdplantatlas.org