The *NatureMapping* Program

Global Positioning System (GPS)

The Global Positioning System is a satellite-based navigation system made up of a network of 24 satellites orbiting the earth about 12,000 miles above us. These satellites are placed into orbit by the U.S. Department of Defense primarily for military applications. In the 1980's, the government made the system available for civilian use. However, the U.S. government used to and still can "scramble" the signals thus affecting the accuracy of GPS equipment. For example, a scrambled GPS reading may be hundreds of meters away from the actual location.

How it works

GPS satellites circle the earth twice a day and transmit signal information to earth. The GPS receiver compares the time a signal was transmitted by a satellite with the time it was received. The time difference tells the GPS receiver how far away the satellite is. The GPS unit needs to receive at least 3 strong satellite signals to find your location by calculating a 2D position – latitude and longitude. With 4 or more satellites in view, the GPS received can determine your 3D position – latitude, longitude, and altitude.

Once the position has been determined, the GPS can calculate other information such as speed, compass bearing, sunrise and sunset time, a route and more.

Accuracy

Most 12 parallel channel receivers are quick to lock onto satellites and are accurate, on average, to 15 meters. Certain atmospheric conditions, ravines, tall buildings, dense forests, and satellites on the horizon rather than right above you can affect the accuracy or cause signal loss. Newer and more expensive models have better accuracy; from 3 meters to the exact location.

The accuracy needed for *NatureMapping* is within a football field, so you don't need to purchase an expensive GPS unit.

The Garmin *e*trex is a dependable, waterproof GPS unit that costs around $100. The top unit shows the sky-view while it is locating satellites. The next unit shows compass direction and speed. The third unit shows setting a waypoint.

There are other settings that are important to the *NatureMapping* Program.

Reporting lat/long in decimal degrees
Most people learn how to read latitude and longitude in degrees, minutes, and seconds. Degrees, minutes, and seconds need to be converted to decimal degrees (with 6 to 7 decimal points for better accuracy) for GIS maps. Many GPS units allow you to change the settings to DD – decimal degrees. If not, the *NatureMapping* spreadsheet has a conversion formula.

How to calculate decimal degrees
Replace the red numbers with yours:

Enter latitude degrees in the cell below
48
Enter latitude minutes in the cell below
3
Enter latitude seconds in the cell below
15

Enter longitude degrees in the cell below
119
Enter longitude minutes in the cell below
11
Enter longitude seconds in the cell below
23

The conversion to Decimal degrees

48.054167

-119.189722

Copy the lat/long numbers and **Paste Special** (select values) into your Data Form.

Datum
Datum was explained in Activity #8. Briefly, a datum is the way geographers explain their maps in relation to the center of the earth. As mapping skills improved and satellite technology advanced, newer maps were created using the newer current standard datum. Examples of datums are: NAD27, NAD83, and WGS84.

It is important to know what datum your GPS is set to when you submit data to the *NatureMapping* Program. The current default on most GPS units is WGS84. If your GPS unit does not have a setup mode (which is the case for some handheld computers with built-in GPS units), then it is set for WGS84.

Why is knowing your datum important?
Paper geographic maps were scanned and became GIS maps. Some maps were drawn using different datums. The datum used is labeled on every topographic map. If a GIS map is using datum NAD27 and your GPS unit was set to NAD83, then the points would not line up correctly on the map.

How do you get the points to line up correctly?
You can use the setup mode on your GPS to make the datum, units, magnetic or true north match the map you are using for your GIS work.

If you are not going to use GIS but just submit your data to *NatureMapping*, then *NatureMapping* will, using GIS terminology, change the projections. We tell the GIS software what the projection (i.e., datum you reported) is for the incoming data and convert these data to align with the projection of our GIS maps.

One last word…..read the GPS manual…you will read statements such as…
CAUTION: IT IS THE USER'S RESPONSIBILITY TO USE THIS PRODUCT PRUDENTLY. The electronic chart is an aid to navigation and is designed to facilitate the use of authorized government charts, not replace them.

More cars are equipped with GPS units telling the driver when to turn to reach a destination, but in some cases, drivers end up lost or worse in lakes or deep gullies. New roads are going in every day and the mapping software companies can not keep up with the changes. Drivers must use common sense if the GPS unit is "telling" them to turn onto a dirt road in the middle of nowhere rather than keeping them on the highway.

People take their GPS units out for a hike and still get lost. A GPS unit can create a route for the user, but the user must set a "waypoint" at the beginning of the hike to remember where the hike began. Batteries can go dead in a GPS unit…paper maps should always accompany a hiker.