Mushroom Documentation 1: Mapping Your Location

A device, such as your smart phone or camera, may record latitude and longitude. This Global Positioning System (GPS) using satellite signals pinpoints your location coordinates on the earth.

The combination of a trail map and compass can help guide you through a park, determine where you are at a given point, and help you find the way out. If you mark points on a map then you can later use a website to determine the latitude and longitude. Patrick uses: http://itouchmap.com/latlong.html

Latitudes start at the equator. Longitudes start at the Royal Observatory in Greenwich in London. When the present system was set up, Britain was the top sea-going country so their largest city became the starting point. In the old days ships set their clocks to the time of the Greenwich Observatory in London, known as Greenwich Mean Time (GMT). Then, no matter where they went, they could tell what their longitude was by seeing what time was on their clock when the sun reached its highest point in the sky at noon. Every hour equals 15 degrees of longitude. If noon came before 12:00 GMT, then you were that many degrees of longitude east of London. Otherwise you were to the west. To find your latitude you measured how many degrees high the north star was – or some other star of known position. All this measuring was done by an astrolabe, later with a sextant. Even without anything special except a clock you will be less than 1000 km off.

The Chicago area is about 42°N and 87°W. The North Park Village Nature Center is 41.9880, -87.7244
The old way for writing this would be : Lat: 41° 59' 16.8" N, Long: 87° 43' 27.8" W.
Most people, at least scientists no longer use degrees, mintutes, seconds but instead degrees only, with decimals.
Before latitude and longitude were easy to measure, people used Township, Range, Section. A map was required.

How many digits? Decimal equivalents for the Chicago Region

Latitude degrees
1 = 111200 m = 111 kilometers = 69 miles
0.1 = 11120 m = 11 kilometers = 6.9 miles
0.01 = 1112 m = 1.1 kilometer = 0.69 mile
0.001 = 111.2 m = 111 meters = 365 feet
0.0001 = 11.12 m = 11 meters = 36 feet
0.00001 = 1.112 m = 1.1 meter = 3.6 feet
0.000001 = 0.1112 m = 11 cm = 4.38 inches

Longitude degrees
1 = 82650 m = 83 kilometers = 51 miles
0.1 = 8265 m = 8.3 kilometers = 5.1356329 miles
0.01 = 826.5 m = 826 meters = half mile
0.001 = 82.65 m = 83 meters = 271 feet
0.0001 = 8.265 m = 8.3 meter = 27 feet
0.00001 = 0.8265 m = 0.83 meter = 2.7 feet
0.000001 = 0.08265 m = 0.08 meter = 8 cm = 3.25 inches

Patrick uses 4 digits in most cases for pinpoint locations measured with GPS or itouchmap.com. Occasionally Patrick uses 5 digits for pinpointing specific mushroom fruiting spots when measured with GPS but the 5^{th} digit is not precise and can vary a little bit while taking a GPS reading. When giving Lat and Long for a site Patrick often rounds off to 3 digits or less. Complicated geolocation mapping applications can compute the coordinates for a polygon for an area or give a point and a radius of error, such as when mapping old data where just a town name is given.

Patrick Leacock, 2 August 2015, MycoGuide.com

What is GPS?

The Global Positioning System (GPS) is a satellite-based navigation system made up of a network of 24 satellites placed into orbit by the U.S. Department of Defense. GPS was originally intended for military applications, but in the 1980s, the government made the system available for civilian use. GPS works in any weather conditions, anywhere in the world, 24 hours a day. There are no subscription fees or setup charges to use GPS.

Smart Phone versus GPS receivers

http://communityhealthmaps.nlm.nih.gov/2014/06/30/how-accurate-is-the-gps-on-my-smartphone/
From numerous tests the typical GPS receiver will achieve an accuracy of 1-5 meters. Unfortunately assisted-GPS accuracies have not been studied nearly as thoroughly as typical GPS receivers. The best studies to date are those by Dr. Paul Zandbergen at the University of New Mexico. In 2009 he published findings showing that an iPhone 3 had an average accuracy of 8 meters. In that study the error never exceeded 30 meters. Below are the results of his 2009 study including all three locational systems.

- 3G iPhone w/ A-GPS ~ 8 meters (requires view of sky for satellite access)
- 3G iPhone w/ wifi ~ 74 meters
- 3G iPhone w/ Cellular positioning ~ 600 meters

Numerous anecdotal studies indicate that the iPhone 4S/5 has become more accurate. In 2011 Dr. Zandbergen tested several Android smart phones. Here he found the accuracies to be slightly better than the 2009 study. They ranged from 5-8 meters. It is likely that the iPhone 4S/5 is within this range as well. It can also be assumed that iPads and other Android tablets will be comparable.

If getting within 5-8 meters meets your data requirements smart phones and tablets are a great way to go.

If you need greater accuracy you can combine an external Bluetooth GPS receiver with your device and get that accuracy down to the 2-3 meter range.

"If you require more accuracy than that you will need to invest in a mapping grade GPS receiver." NOTE: Garmin® GPS receivers are accurate to within 15 meters on average. Newer Garmin GPS receivers with WAAS (Wide Area Augmentation System) capability can improve accuracy to less than three meters on average. No additional equipment or fees are required to take advantage of WAAS.

Patrick has compared results between using a Garmin GPS and the website http://itouchmap.com/latlong.html
The Latitude and Longitude obtained by either method are very similar, to within a few meters.

Here is a test that compared various devices:
http://www.singletracks.com/blog/gps/gps-distance-accuracy-test-smartphone-apps-vs-dedicated-gps/

GPS units never know exactly where you are located–they're only accurate to within a few feet. So each time a GPS checks with the satellite, it's calculating a slightly different position, even when you're not moving.

See also a wealth of information on the web. Examples:
http://www8.garmin.com/aboutGPS/
https://en.wikipedia.org/wiki/Global_Positioning_System
https://en.wikipedia.org/wiki/Geolocation
https://en.wikipedia.org/wiki/GPS_navigation_software For a computer

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