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Effectiveness of Using Points as Opposed to Lines in Mapping Trails with the Legend GPS and iPAQ

Introduction

I have often used a GPS to mark locations while hiking and plan out routes. In doing this, I have noticed that many times when in heavy leaf cover or in steep sided canyons the signal is not adequate to give accurate results. As a result of this, I decided to see how well the GPS with iPAQ would work in mapping a section of trail that has open areas as well as sections near a steep-sided mountain with trees. I first learned of using lines and points with GPS mapping while doing laboratory exercises on the Quad.

The object of this experiment was to see how well the different lines plotted with the GPS matched what was shown on the map or derived from an aerial photograph.

The area chosen was based on the variety of terrain within a relatively short distance and something I was familiar with. Therefore, I chose a location on the trail near Wood Camp Campground leading to Jardine Juniper.

Materials and Methods

For this study I used a Garmin Etrex Legend in combination with an HP iPAQ Pocket PC running HGIS software. Before I began collecting data, I noticed the iPAQ and connections to the GPS seemed prone to breakage so I devised a cradle to support the iPAQ and cable leading to the GPS.



The cradle consists of a length of plastic ruler to which the data cable is taped with red tape. The iPAQ simply plugs in and is attached with the two rubber bands as in the picture

In order to keep the GPS unit out of the way and in a position to get the best signal, I mounted it on a wooden rod which was attached to my backpack. In the picture you can just barely see the GPS unit to the left of my head.



Before any data collection began, I needed to download an aerial photograph and topoquad and plot where the trail ran using the draw feature of HGIS. This would enable me to compare the data I gathered while hiking to what I interpreted from the map. The topoquad used was made 7/1/1981. The aerial photograph used was taken 8/23/1993. Both were obtained from www.terraserver-usa.com and in the North American Datum of 1983. The data was gathered on the same day within a two hour period. The data was collected in three different ways; continuous line with position data collected every second, continuous line with position data collected every 15 seconds, and points with position data collected every 15 seconds. The data consisting of only points was later connected dot-to-dot style manually. For viewing data on my personal computer, ArcExplorer2 was used.

Results and Discussion

The first mapping trip used the continuous line feature of GPS draw on HGIS. As you can see from the picture, it does not compare very closely with the line (trail) derived from the map. The traced trail is orange. The trail with one second collection intervals is purple and the trail with 15 second collection intervals is blue.

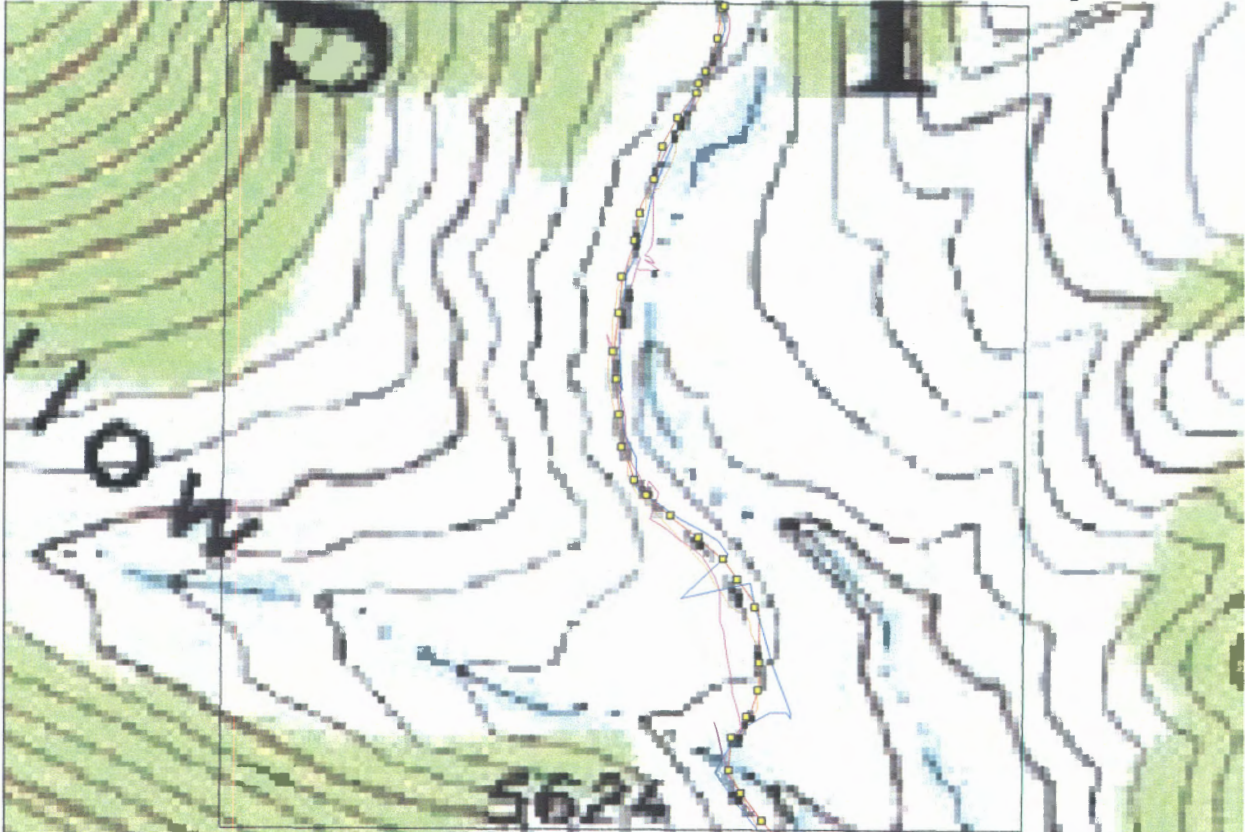


You can clearly see the purple and blue lines are somewhat random and do not accurately represent the actual location of the trail.

For the final mapping while using points collected every 15 seconds, the data more closely matched that from the map. In this figure, the orange line is data collected by tracing the trail on the map. The yellow points are the data gathered, and the red line represents my manually connecting the points.



This picture shows how each line compares with the line traced from the map.



Unfortunately, the map is a raster image so zooming in so close greatly pixelizes the image.

It was noted very quickly that mapping with this combination of GPS and iPAQ in the mountains or anywhere where there is terrain or vegetation that blocks reception will cause quite a few errors in the data gathered, at least at this resolution.

Some of the limitations of the iPAQ are its vulnerability to damage, battery life, and ability to view the data on a computer, unless of course you have HGIS on all your machines.

Conclusion

From this study I believe it is feasible to map trails. Collecting individual points and manually connecting lines could be tedious, but works better than having a continuous line drawn. Another thing that may improve the mapping experience would be a better GPS or more powerful antenna, as well as a waterproof iPAQ (or just don't go in the rain).