Evaluating Methods for Collecting Spatial Data in Closed Canopies and Rugged Terrain

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# Introduction

Geospatial data can be collected with a variety of types of equipment including Hand-Held Global Positioning System (GPS) units, magnetic compasses, and laser range finders. Handheld GPS units vary in their accuracy based on the model and the model and the number of satellites available (Drosos and Malesios 2012). In some situations, researchers can obtain higher accuracy with a compass and laser range finder than with a GPS. However, using a compass and range finder has different accuracy issues (Julián & Daniel, 2015).

The goal of this report is to determine the uncertainty of two types of equipment for collecting spatial data: 1) GPS, and 2) Compass and Range Finder.

# Methods

We obtained a Nikon 16703 Forestry Pro II Laser Rangefinder, a compass, and a Garmin eTrex 10 GPS handheld from the Forestry Stockroom at Humboldt State University. Then, we downloaded the protocol. Then, we created a field sampling protocol document (see Appendix A) with the following data fields:

1. Feature(tree) or Benchmark number
2. GPS Easting
3. GPS Northing
4. Compass Direction (a.k.a. azimuth, bearing)
5. Distance
6. Height (optional)
7. Notes

We began surveys in the HSU parking lot that is just to the south of the Campus Center for Appropriate Technology (CCAT). We established a benchmark by selecting the \_\_\_\_\_\_\_\_\_\_\_\_ feature as it would be visible in aerial imagery. We took a way point at the benchmark and recorded it as Feature 1. We then took direction measurements using a \_\_\_\_\_\_\_\_\_\_\_ and distance measurements using a \_\_\_\_\_\_\_\_\_\_\_\_\_\_ to the first tree and recorded them in our field sampling protocol document. We moved to the first tree and then repeated this process for \_\_\_\_ trees. At our final tree, we recorded compass and distance measurements to \_\_\_ additional trees. We took turns using the equipment to make sure that everyone had a chance to work with each method. We also reviewed each entry as a team to reduce errors in recording.

We began analysis by downloading the GPS waypoints to a computer using DNRGPS version \_\_\_ from the Minnesota Department of Natural Resources and loaded them into ArcGIS Pro Version \_\_ from Esri. We exported the waypoints to a Comma Separated Value (CSV) file and then loaded this file into Microsoft Excel version \_\_ and added the distance and direction values to the CSV file and saved it as an Excel file. We separated the benchmark coordinates and the direction and distances to trees into two separate spreadsheets and then computed Standard Deviation and Root Mean Squared Error (RMSE) for the benchmark coordinates and computed the coordinates of the trees using:

We compared the GPS coordinates to the coordinates obtained using the compass and range finder. And found the difference between the coordinates.

# Results

The results section is where you should place your final output. This typically includes tables and figures. A good approach is to write text about a result that is shown in a table and/or figure and then reference the table and/or figure and have it follow the paragraph. As an example, the table below shows the results of our analysis of the land use within Humboldt County (Table 1).

Table 1 Summary of land use within Humboldt County

|  |  |  |  |
| --- | --- | --- | --- |
| **Land Use Type** | **Number of Parcels** | **Number of Acres** | **Percent of the Total** |
| Agriculture | 196 | 2713 | 2.1 |
| Religious | 1458 | 50046 | 0.01 |
| Urban | 103 | 400 | 0.7 |
| Industry | 22420 | 17333 | 0.09 |
| Open | 1191 | 1794 | 25 |
| Residential | 103 | 2094 | 5.0 |
| Timber | 3005 | 581221 | 57 |
| Commercial | 1077 | 14480 | 0.08 |
| Public  | 23165 | 115593 | 0.6 |
| Tribal | 8026 | 1312892 | 4.0 |

As another example, the figure below shows the spatial distribution of various types of land use within Humboldt County (Figure 2).



Figure 2 Land use within Humboldt County (Source: Humboldt County GIS)

# Conclusion

State the main findings of your study and discuss the implications of the results. State what you would recommend for the next steps to improve your findings.

# Acknowledgements

Acknowledge anyone that helped with the study that is not otherwise mentioned.

# References

Drosos, Vasileios C. and Malesios, Chrisvaladis (2012). Measuring the Accuracy and Precision of the Garmin GPS Positioning in Forested Areas: A Case Study in Taxiarchis-Vrastama University Forest. Journal of Environmental Science and Engineering B, 2012 , pp. 566-576.

Julián Tomaštik & Daniel Tunák (2015) Compass measurement – still a suitable surveying method in specific conditions, Geodesy and Cartography, 41:1, 31-40, DOI: 10.3846/20296991.2015.1011863

# Appendix A

Add an appendix to include any information you feel is important but does not belong in the body of the text. This could include protocol forms, program listing (i.e. code), additional tables and figures that are too long or numerous for the body of the report.