Surveying Burns Park: Dominant Plant Type, Elevation, and Noise Level

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OBJECTIVE

The objective of this study is to collect measurable and specific data on dominant plant type, elevation (in feet), and noise level (in decibels) along evenly spaced transect lines in Burns Park. The project entails a planning stage before data collection, acquiring data in the field, correctly defining and projecting the data, presenting the collected data on cartographically correct maps, and analyzing the results of the study.

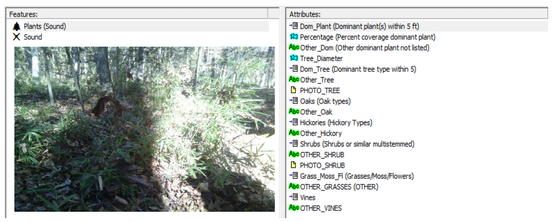
GENERAL WORKFLOW

- Develop transect points for navigation in the field
- Prepare data dictionary for data collection on site
- Make a collection plan based on DOP and satellite availability data for the day of collection, courtesy of Trimble GNSS Planning Online
- Collect sound and dominant plant points
- Differentially correct GNSS points in post
- Export corrected points to shapefile and define projection in ArcMap
- Display in ArcMap and export to correct projection for Burns Park
- Analyse results

PREPARING TO COLLECT

First, a north/south baseline was established using a shapefile created by Mary Sue Passe-Smith. Then 320 foot transect lines were drawn due east. Starting at the northern most tip of the baseline, a transect line was drawn every fifty feet further south for a total of fourteen transect lines. On each transect line, ten receiver collection points evenly spaced at intervals of forty feet were drawn. This was done to create evenly spaced collection points within the area of interest that could be uploaded to the GNSS receivers and easily navigated to on the day of collection.

A complex data dictionary was designed prior to the day of collection to aid the collectors in producing streamlined and measurable results when collecting data out in the field. The two features collected were dominant plant type within a five-foot radius and noise level at the point of collection. The dictionary for noise was relatively simple, only needing one attribute: decibels. Dominant plant type, on the other hand, consisted of a total of 18 attributes. Two attributes are required each time a point is collected: "Dominant plant type" and "Percentage" (of dominant plant type). Many of the attributes are required if a specific series of selections are made. For example, if the dominant plant type is "Trees," then "Tree Diameter" and "Dominant Tree Type" become required fields in order to finish collecting the point. This branching series of *if/then* statements is important to ensure that each point collected has all the necessary information for analysis. Photos of many of the plants were uploaded in the data dictionary to make identification easier on the collector. Seven of the attributes are simply "other" options designed to allow for other inputs besides the selectable options listed on each attribute. If the plant type is not listed in the data dictionary, but also unknown to the collector, a photo may be necessary for proper identification at a later date. A photo attribute was supposed to be added for each of the four dominant plant types (Trees, Shrubs, Grasses, and Vines), but a mistake was made when developing the data dictionary. Because of this, only "Trees" and "Shrubs" had photo attributes loaded. This affected the study, because my team needed to photograph a vine to identify later, and had no option to do so.

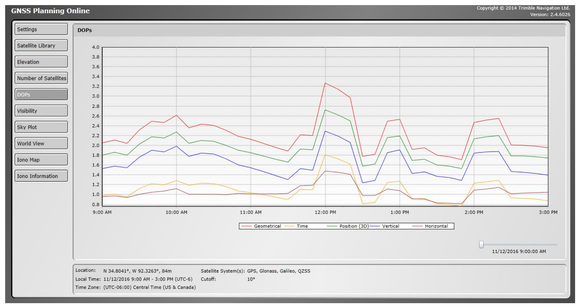


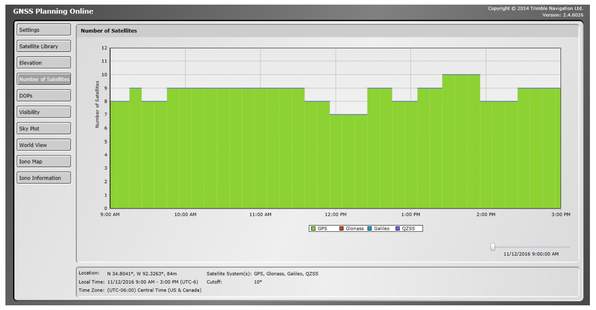
DATA COLLECTION AND EXPORT

Each team member collected nine consecutive points along a transect line for each of their two features (sound and dominant plant type). Once the 18 total uncorrected GNSS points were collected, they must then be uploaded into GPS Pathfinder Office to be differentially corrected and exported. Differential correction can be done in the differential correction wizard, where the points are both code processed and carrier processed for greater accuracy. Next, a base provider must be selected. When selecting a base provider, one must consider distance from that base station (as that affects overall accuracy) as well as high integrity. High base station integrity relies on 3 criteria: reliability, reference position bias, and base station receiver precision. The Pulaski Area Geographic Information System (PAgis) was selected as the base provider for this project due to its close proximity and high integrity index rating.

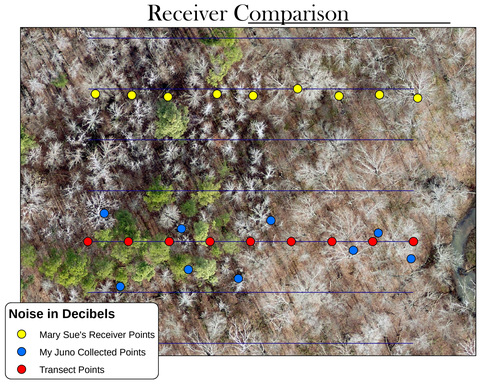
Once the points have been differentially corrected, they must be exported (ITRF 2000) and displayed in ArcMap. In order to do this, the projection must be defined as GCS WGS 1984, since this is how they were collected, and then exported into the correct coordinate system, NAD 1983 State Plane Arkansas North FIPS 0301, using feet as the unit of measure. One point in particular benefitted from the differential correction. The corrected point (blue) shifted over 21 feet from its uncorrected position (red). The PDOP of the point was 8, which is double the max PDOP to receive an excellent rating, which is 4. It is also four times the predicted PDOP at the time, which was roughly 2. This lack of accuracy is very likely multipath due to the thick canopy of trees obstructing the receiver. The dominant plant type at the point in question is trees, and trees can clearly be seen at and around the location of the point (right).

DILUTION OF PRECISION





Receiver Comparison

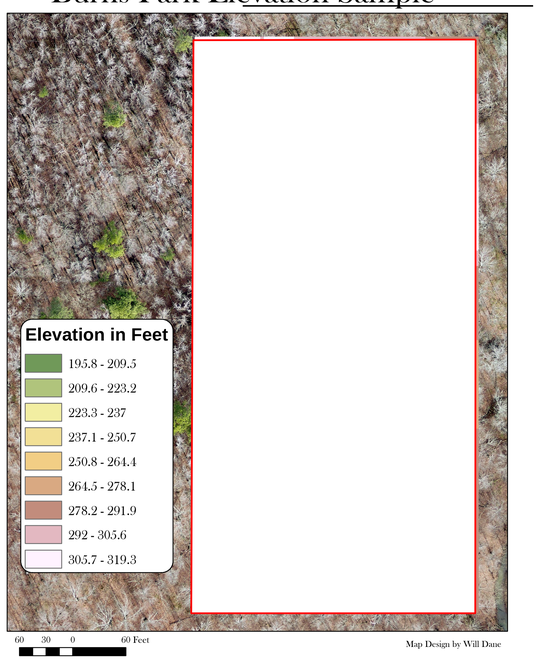


ANALYSIS & DISCUSSION

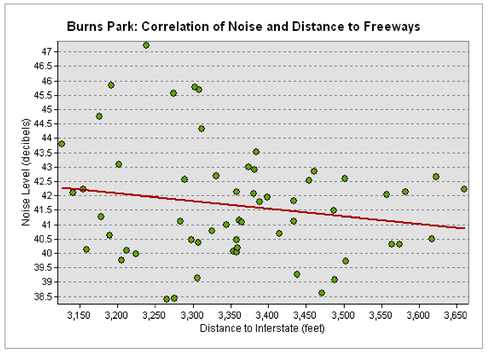
Based on the Burns Park noise level map and its 3D surface layer, it is clear that the loudest portion of the study area is at the northern end. Interestingly, the quietist portion of the study area is located just southeast of the highest decibel peak. Analyzing the peaks and valleys of the elevation surface and the noise surface, there don't seem to be many correlations, indicating that elevation is not a major factor in noise level. Noise is negatively correlated with distance from the interstate, however, as shown by the scatterplot below and the downward sloping trend line along the graph. This is evidence of noise pollution, which can have dramatic effects on the animals living nearby, and should be considered in the planning of future interstates.

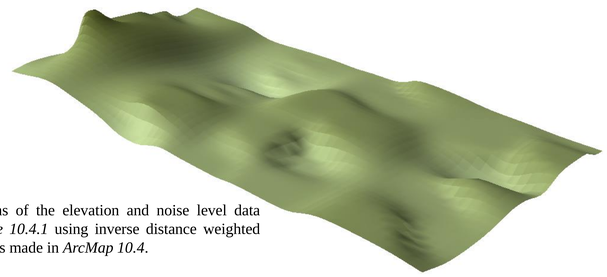
Receiver accuracy was an issue during the collection process. In the receiver comparison to the left, the red dots represent the transect points (i.e. the target location), while the blue dots represent points collected using the Juno handheld receiver. The yellow dots were collected by Mary Sue Passe-Smith using a more accurate handheld receiver. Mary Sue's points clearly follow the transect lines more accurately than mine do. If all the points were collected using her device, the collection points would be more evenly distributed.

Burns Park Elevation Sample

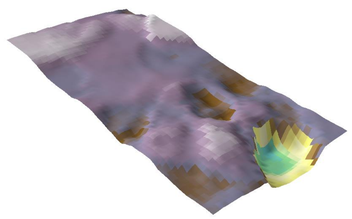




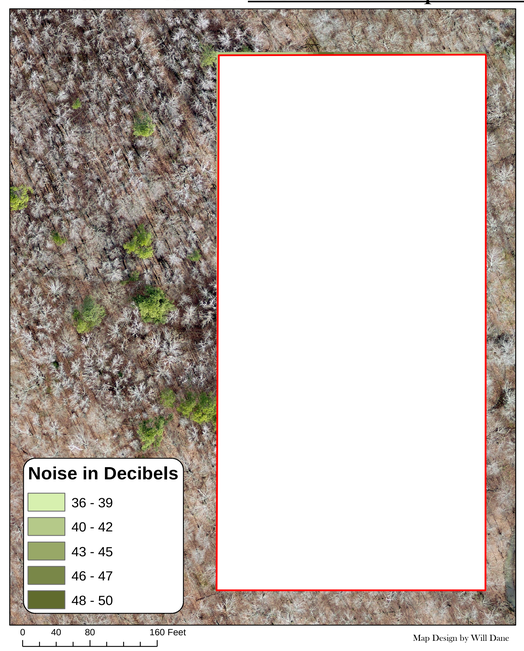




3D surface visualizations of the elevation and noise level data were drawn in *ArcScene 10.4.1* using inverse distance weighted interpolation (IDW) maps made in *ArcMap 10.4*.



Burns Park Noise Level Map



ACKNOWLEDGEMENTS

- Juno handheld GNSS receiver by Trimble
- ESRI *ArcMap 10.4* & *ArcScene 10.4.1*

A special thanks to Mary Sue Passe-Smith for her patience and guidance during this project

REFERENCES/DATA SOURCES

- ESRI/TomTom
- Trimble GNSS Planning Online
- "How Noise Pollution is Changing Animal Behavior" published in *The Conversation*