Foundation Lightning Hazard Map of College Station

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Abstract:

In this study, we studied potential lightning hazards through the analysis of elevation differences, specifically present in Texas A&M University's newest addition, Aggie Park. Using Trimble Real Time Kinematic (RTK) equipment, our team conducted a survey around the lake at Aggie Park and interpreted and analyzed the elevation data. Using ArcGIS Online, we created a map to display our data in polygons and compared our findings to public datasets composing of the lightning hazards risks found across the city. The study combines lightning research and the use of GNSS equipment and technology to determine physical vulnerability. The goal of our research is to determine whether Aggie Park has an elevation difference significant enough to post threats to the public and to ensure the safety of the people at Aggie Park.

Introduction:

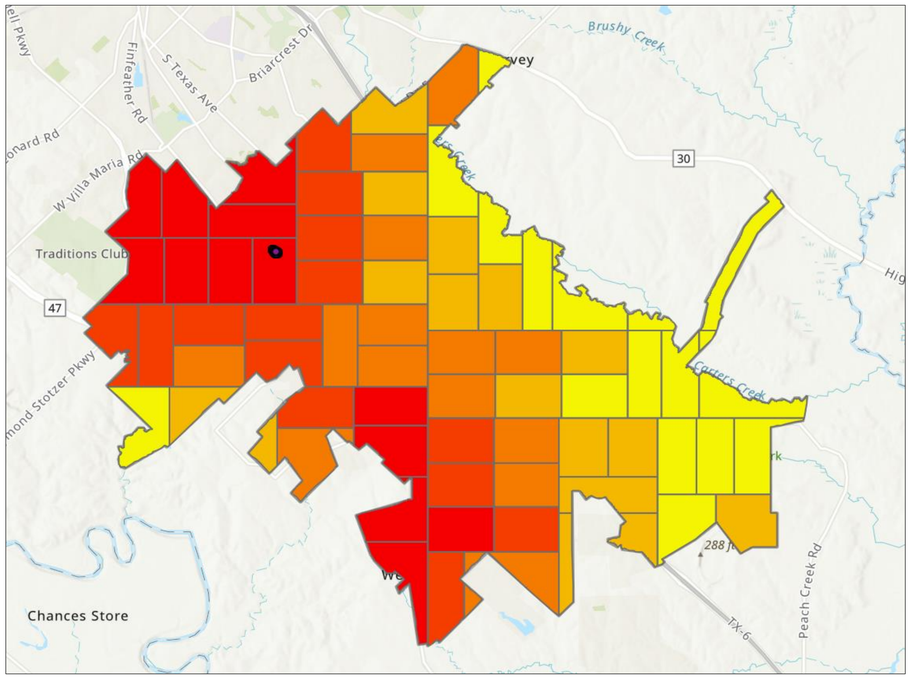
Aggie Park at Texas A&M University has quickly become one of the biggest additions to student life and the College Station community. The 20-acre park caters to outdoor study space, recreation sports, concerts, fishing, and provides sufficient space for events such as Aggie Ring Day. Due to the park's high capacity, our team raises the question of safety in the case of extreme weather conditions such as thunderstorms. This study uses RTK GNSS technology to determine elevation difference along the lake at Aggie Park and analyzes the risks on physical vulnerability.

Methods:

Surveying process: Real-Time Kinetic (RTK) Equipment was used in order to collect data on the latitude and longitude of points and their elevation. The receiver is attached to the top of the surveying pole, which was then held by a surveyor. Another surveyor held the receiving device which displays the data while the other walks around the survey site and receives signals from GPS satellites that determine the point's location through space. Data were collected every few feet around the perimeter of Aggie Park on the walking path and the lake within and were averaged over a period of 10 seconds. In this case, it is not receiving corrections from reference stations because only one pole and receiver were used.

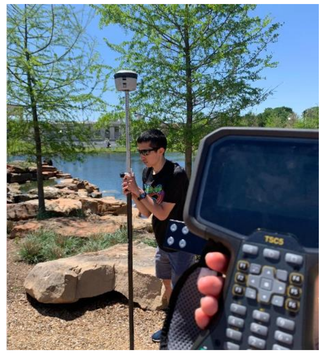
Data Points:

To add the data recorded into a web map, the points had to be compiled into a spreadsheet and converted from their Northing-Easting format to Latitude-Longitude format. This was done using the Earth Point website because it allowed for input that was recorded in U.S. Survey Feet. Once the coordinates were converted into Latitude-Longitude format, a new point feature layer was created in ArcGIS Pro, and the default settings were adjusted to record a Z field in addition to the X and Y fields. Exact data points were added using the "Create Features" tool and inputting the Latitude (X), Latitude (Y), and elevation (Z), all of which were measured in feet. This process was repeated twice, once for each set of data collected, so data around the lake and data along the walking path could stay separate. Once both feature layers were complete, they were exported as individual web feature layers and added to the ArcGIS Online map.



ArcGIS Online Map

The map above demonstrates the lightning hazard risks across the city of College Station. The color gradient in the map directly correlates to the risk factors where the darker shades demonstrate higher risks to lightning strikes. The color gradient from the darkest red shade to lightest yellow shade refer to the following elevations: 320-350, 310-290, 290-270, 270-220 in USFT. The purple dots on the map refer to the data points taken during the survey.



Light poles/flagpole:

At Aggie Park, the abnormally tall flagpole had a height of about 80 ft, and the light poles had an average height of 20 ft. These structures that were scattered around the park are significant to the study because they are very tall, metallic objects, hence they would be prone to lightning strikes and a danger to people that happen to be nearby. In essence, it is strongly advised to stay away from structures such as light or flag poles during a thunderstorm to prevent serious injury or possibly even death by lightning strike.

Results:

Our survey found that the largest elevation difference was approximately 10.34 feet. We found that the lowest elevation was located on the northeast bank of the lake while the highest elevation was located on the walking path slightly north of the lowest point. Through our research we found that elevation differences across college station range from 220-350 feet with the highest elevations posing higher risks. Despite the possible limitations of the use of standalone GPS surveying where the accuracy ranges from 1-3 meters and the windy conditions of the day we surveyed the park, we found that aggie park does not have an elevation that would generally contribute to lightning strike likelihood. In our recommendation, we strongly advise to stay away from structures such as light or flag poles during a thunderstorm to prevent serious injury or possibly even death by lightning strike.

References:

1. Robinson, D., Weather library lightning myths: Small metal objects attract lightning. https://stormhighway.com/small_metal_objects_attract_lightning_myth.php
2. Aggie Park FAQ. Aggie Park, 2021. https://aggiepark.tamu.edu/faq/