Changing Topography of UW Bothell

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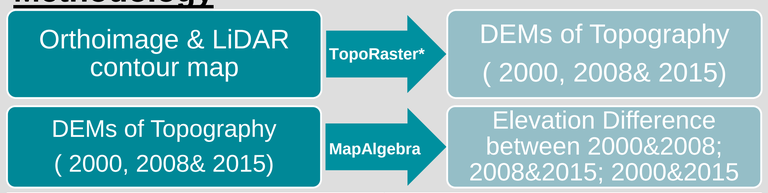
Background

The City of Bothell provided us with historical topographical data of the University of Washington Bothell (UWB) campus for us to analyze the changing landscape and elevation of the area. We obtained topographical vector data of the UWB campus for the years 2000, 2008, and 2015 respectively. The data were collected by the City of Bothell using Orthoimagery (2000 and 2008) and LiDAR data (2015). Our goals for this project are: 1) derive digital elevation models that most accurately represent the UWB campus topography using the Topo-to-Raster technique in an ArcMap environment and 2) compare changes in elevation over time. Our intent is to account for the errors that may arise when interpolating three datasets that were collected using two different remote sensing techniques. We use a Map Algebra framework to compare changes in topography between 2000 and 2015.

Methodology



TopoRaster* Feature Layer	Type
2000;2008;2015 Elevation	Contour
Strems and Rivers	Streams
Water Bodies	Lake
Buildings	Exclusion

Topo-Raster Technique

The Topo-Raster technique for the creation and analysis of our Digital Elevation Models (DEMs) was integral to our investigation. The Topo to Raster tool in ArcMap is a powerful interpolation tool that allows us to produce precise Digital Elevation Models of the study with considerations of hydrological features, buildings, and contour lines in 2000, 2008, and 2015 respectfully. Topo to Raster takes the information provided by the contour to create a general model for the drainage system of the study area and then creates a network of curvilinear streams and ridges which intersect the points of maximum curvature (Hutchinson, 1988). We began with a vector contour lines and interpolated this elevation information along with location of buildings (corresponding to the year), waterbodies, and streams. For each year, we interpolated a shapefile of the buildings for that particular year (using an 'Exclusion' type for the buildings input), the stream running from Beardslee Boulevard to the Sammamish river year (using a 'Stream' type for the creek input), and waterbodies on campus year (using a 'Lake' type for the waterbodies input). We also used MapAlgebra to compare the DEMs and changes in their topography between 2000 and 2015.

Results

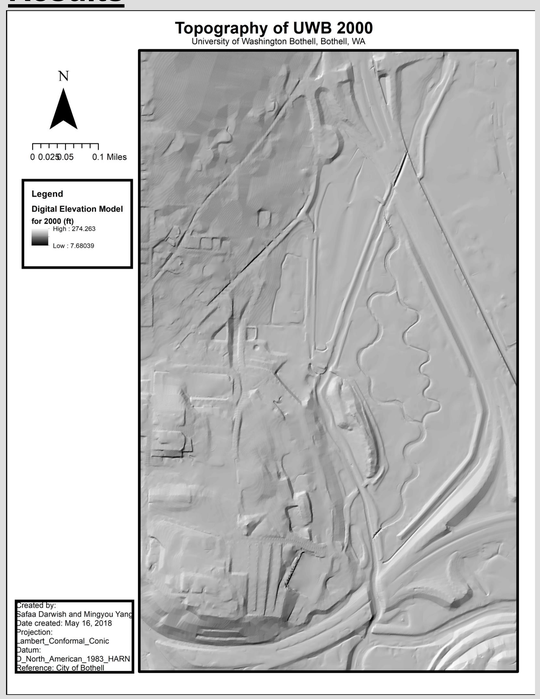


Figure 1. Map showing the topography of the University of Washington Bothell Campus in the year 2000

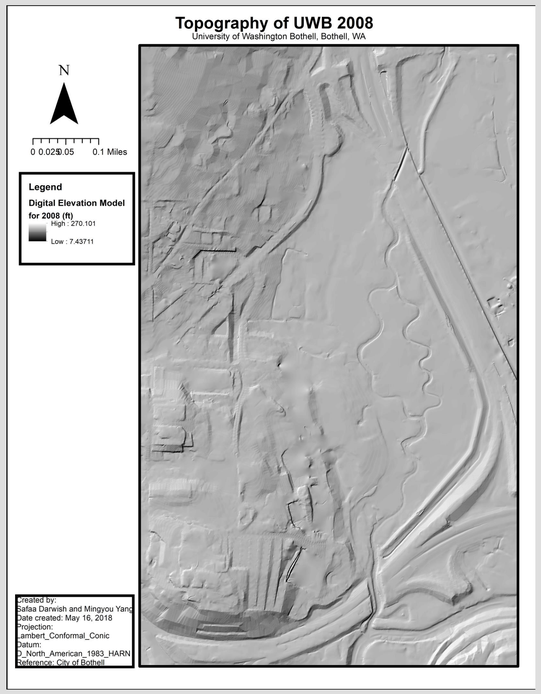


Figure 2. Map showing the topography of the University of Washington Bothell Campus in the year 2008

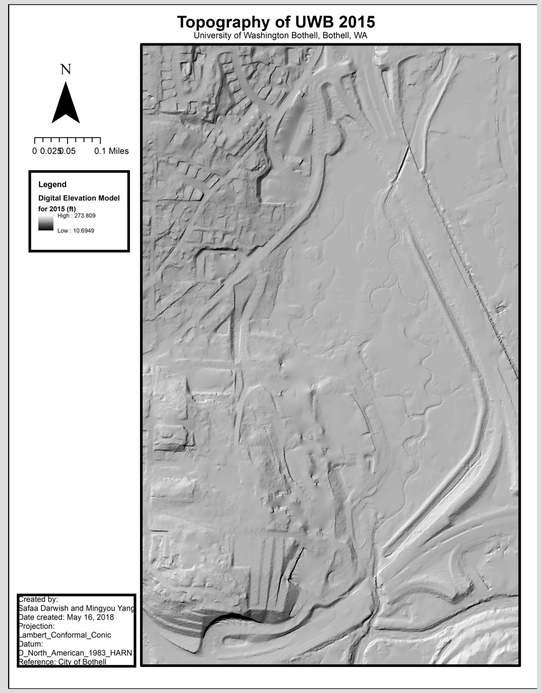


Figure 3. Map showing the topography of the University of Washington Bothell Campus in the year 2015

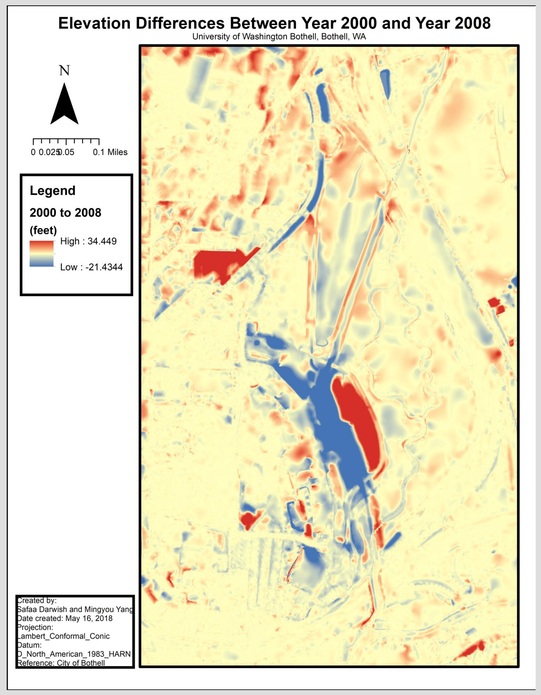


Figure 4. The changes in elevation from 2000 to 2008. Red indicates a reduction in elevation and blue indicates an increase in elevation in 2008.

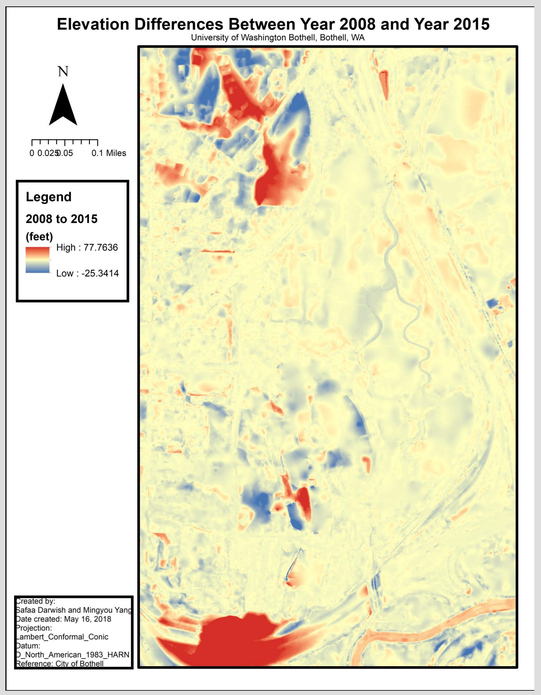


Figure 5. The changes in elevation from 2008 to 2015. Red indicates a reduction in elevation and blue indicates an increase in elevation in 2015.

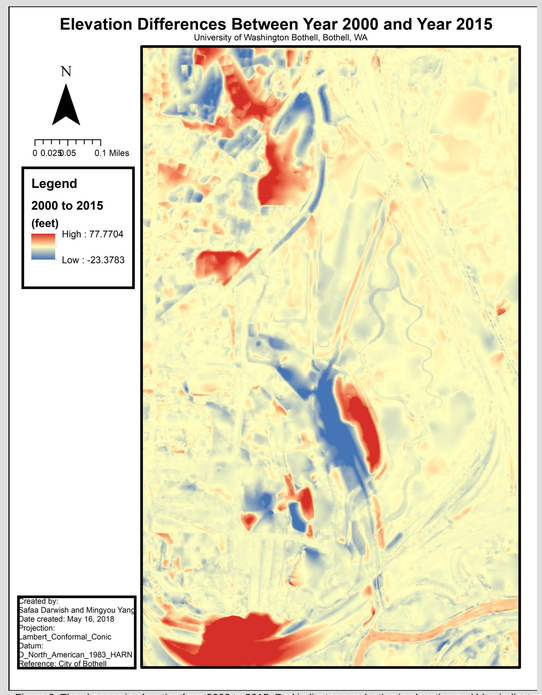


Figure 6. The changes in elevation from 2000 to 2015. Red indicates a reduction in elevation and blue indicates an increase in elevation in 2015.

Discussion

Figures 1-3 are digital elevation models for the years 2000, 2008, and 2015 respectively. Observe the way the river in 2000 (figure 1) cuts relatively deep into the land and gradually softens in 2008 and 2015. If we compare this to the elevation differences (figures 4-6), we see that in between 2000 and 2008 (figure 4) the red tinges on the bends of the river indicate erosion, perhaps having been affected by the removal of the canal and suddenly compensating for more runoff than usual. The difference between years 2008 and 2015 (figure 5) indicate deposition along the river and yet not as extreme as the deposition in the previous eight years. Lastly, in figure 3, we see only deep cuts into the topography at the entry point from under Beardslee Boulevard and exit into the Sammamish river.

The campus has had several buildings, a new parking lot and even a freeway entrance added between 2000 and 2015; this is reflected in the changing topography of the campus. We see the most changes in topography where there has been construction. Figures 4-6 shows the changes in elevation relative to the mean. Figure 4 shows a canal running through the wetland, the red indicates that this elevation was higher in 2000 than in 2008 which makes sense because the canal was removed between these two years.

Figure 5 shows the change in topography between 2008 and 2015; the large red patch indicates that land was dredged between 2008 and 2015 (a reduction in elevation for 2015); a connection to the Bothell campus and I-405 which accounts for the large reduction in elevation seen here.

Figure 4 shows that much blue (an increase in elevation in 2008) is concentrated on the main campus where buildings and the sports field were added. Figure 6 shows the change in topography from 2000 to 2015; the most drastic changes over the course of fifteen years are seen in the housing development (Northwest corner of figure 6) which is bright red, indicating loss in elevation; down a little further, the red elevation loss is the location of the Husky Building.

Moving down to the center of figure 6, we see a deep blue where the sports fields were added and interestingly, a deep red where there was a decrease in elevation between the sports field and the wetland.

Finally, the most drastic change is seen on the lower Southwest corner of figure 6, where there was around seventy-eight feet of elevation lost due to the installation of the freeway entrance.

Conclusion

We observed a significant change in topography over the course of 15 years, particularly in the wetland area adjacent to UWB as well as the UWB campus itself. There are significant elevation changes where a connection was made between the campus and I-5 in 2015. Our intended future work will include comparing vegetation coverage over the years and investigate how they relate to topographic and hydrological changes.

Sources: Hutchinson, M. F. 1988. Calculation of hydrologically sound digital elevation models. Paper presented at Third International Symposium on Spatial Data Handling at Sydney, Australia.
Geodatabase provided by the City of Bothell.