Sound Mapping in Greenville County

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Purpose

To analyze the propagation of sound created by traffic and other sources in the landscape using a GIS based modeling approach.

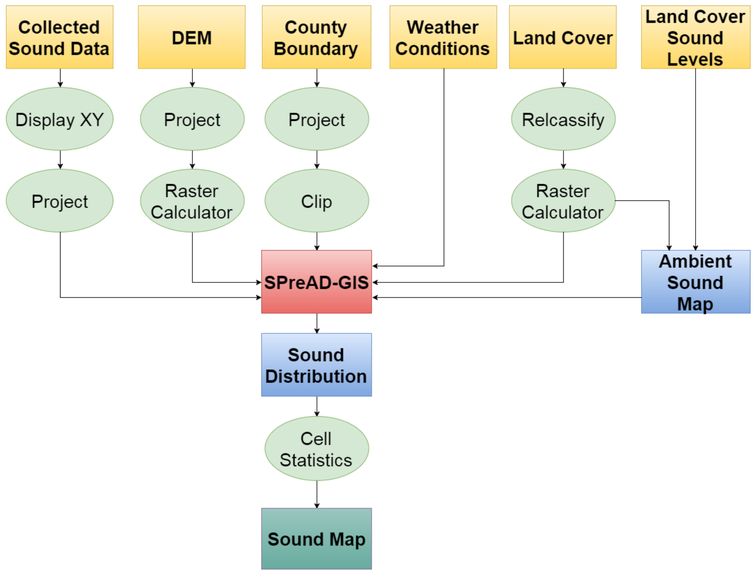
Project Summary

As land use becomes more urban, a byproduct is increased noise levels. An increasing concern among biologists is the impact of these noise levels on wildlife, specifically birds, and whether the noise is negatively affecting their communication. Using sound level data collected throughout Greenville County, I was able to model the spatial distribution of the sound using the toolbox SPreAD-GIS for ArcGIS, developed by Reed, Boggs, and Mann (2012). The model accounts for the effects of elevation (DEM), land cover types, ambient sound levels, and weather conditions on sound distribution. This tool has a great potential for mapping sound in future biology and GIS projects, but more data points clustered closer together than this experiment di in order to provide a more accurate model of the sound in the area.

Background

The increasing amount of people in urban spaces creates higher levels of low-frequency noise than the ambient levels than the natural levels of outdoor environments (Katti & Warren, 2004). The main sources of human-created sound are from the traffic of automobiles, creating a more continuous sound than in natural environments (Wood & Yezerinac 2006). In humans and animals alike, continuous exposure to high levels of noise can have negative psychological health effects from increased stress (Campo, Gil, & Davila 2003). Reed, Boggs, and Mann (2011) developed SPreAD-GIS, a free open-source toolbox for ArcGIS, that models the spatial spread of noise. SPreAD-GIS models for losses due to spherical spreading, atmospheric absorption, land cover, wind direction, elevation, and weather to create a relatively accurate representation of reality (Reed, Boggs, Mann 2011).

Methods



References and Data Sources

1.Dr. John Quinn in Biology for Sound Data
2.Greenville County GIS
3.Campo, J., Gil, M., & Davila, S. (2005). Effects of specific noise and music stimuli on stress and fear levels of laying hens of several breeds. *Applied Animal Behaviour Science, 91*(1), 75-84.
4.Katti, M., & Warren, P. S. (2004). Tits, noise and urban bioacoustics. *Trends in Ecology & Evolution, 19*(3), 109-110.
5.Sound Chart came from Kid Press Magazine
6.Reed, S. E., Boggs, J. L., & Mann, J. P. (2012). A GIS tool for modeling anthropogenic noise propagation in natural ecosystems. *Environmental Modelling & Software, 37*, 1-5.
7.South Carolina Department of Natural Resources for Land Cover
8.Wood, W. E., Yezerinac, S. M., & Dufty, J., AM. (2006). Song sparrow (melospiza melodia) song varies with urban noise. *The Auk, 123*(3), 650-659.

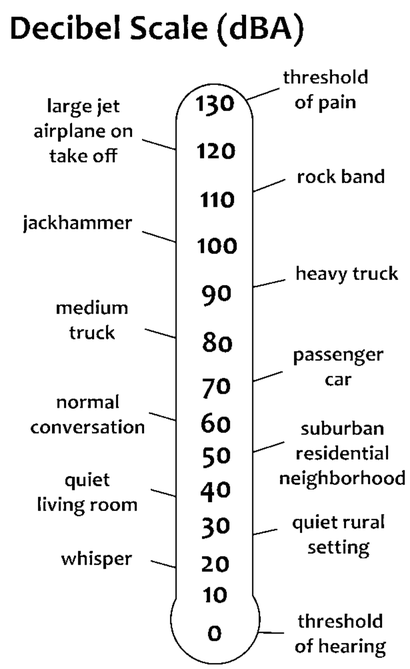


Figure 1. This is a scale displaying the sound levels of various activities. This gives us a comparison to base our results on Source: Kids Press Magazine

Sound Distribution Across Greenville City

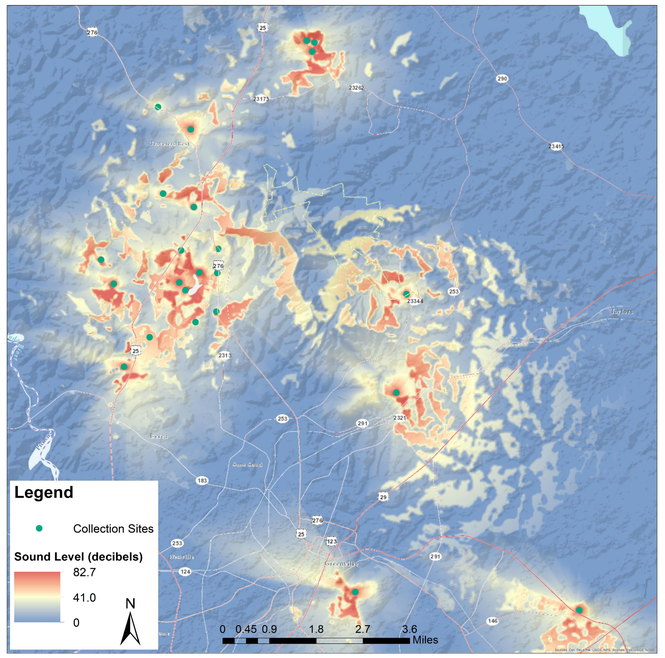


Figure 2. This map is showing the results of the SPreAD-GIS model ran at 1000 hz for all of the collection sites across Greenville County. The collection sites are marked in green and give a representation of the sound around them.

Sound Distribution Across Paris Mountain

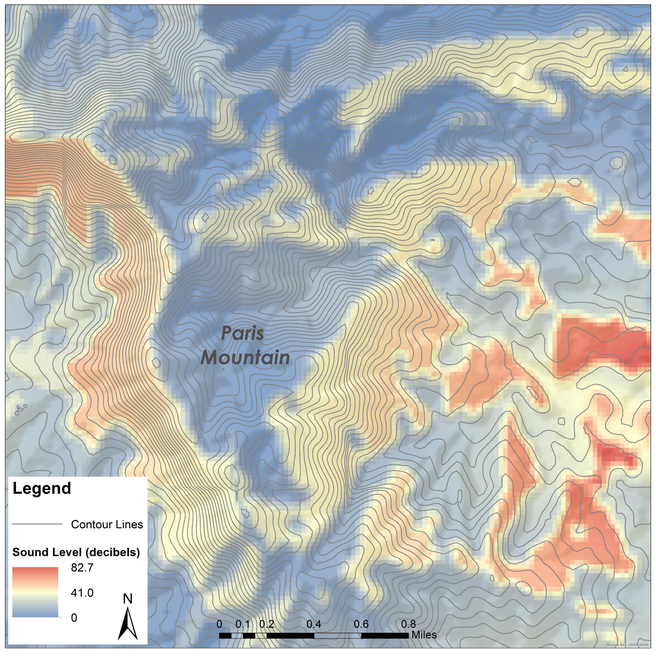


Figure 3. This map shows how elevation affects the spatial spread of sound. The steep rise in elevation at Paris Mountain stops the spread of noise from the west and east.

Sound Distribution Across Furman

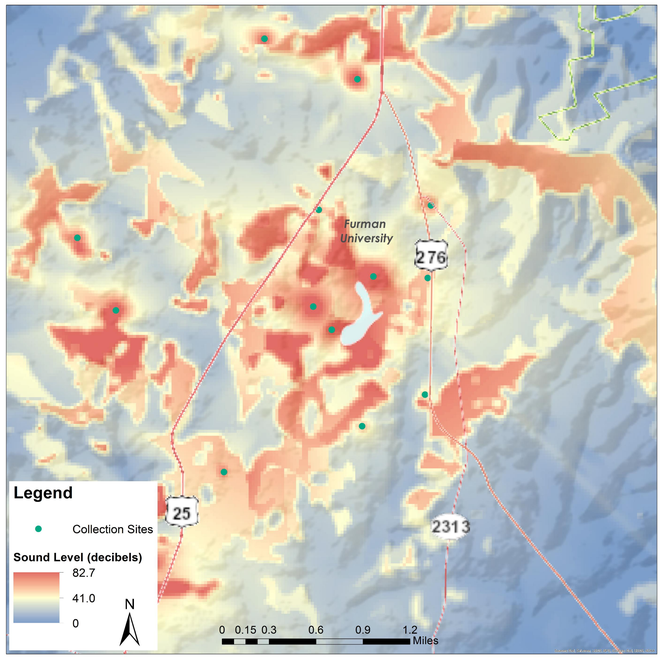


Figure 4. This is a map showing the spread of sound around Furman University. The area around Furman had the largest cluster of recording sites making it the most accurate, but could be improved with a strategically placing of sound collection sites in areas that lack readings, or the areas in blue.

Conclusion

Results from this research provides the first step for understanding the potential impact of human-made noise on ecosystem integrity and biodiversity. This project demonstrates the use of SPreAD-GIS for sound modeling research in Greenville County. When choosing more recording sites for future sound analysis, the elevation of the land and determining an appropriately small distance between recorders should analyzed to reduce gaps in sound data.