A101 The Application of Geographic Information Systems (GIS) to the Migrant Crisis in South Texas: Modeling Migration in Brooks County, Texas

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Learning Overview: After attending this presentation, attendees will understand the benefit of applying GIS to evaluate the movement of migrants through the South Texas landscape.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by informing on search strategies for missing migrants, which will increase recovery rates and aid in optimizing the placement of water stations throughout the landscape.

Current immigration policy and border enforcement strategies have contributed to an ongoing humanitarian crisis at the United States-Mexico border, as people continue to migrate north fleeing poverty and violence. As migration from Central America surged, Texas surpassed Arizona in migrant deaths, resulting in thousands of deaths and unidentified human remains recovered across the South Texas landscape.[1] Much of the current recovery and identification efforts in Texas have centered around Brooks County, where more than 600 presumed migrants have been recovered from 2009 to the present. However, missing persons records largely outnumber unidentified recoveries, indicating that many of the missing have not been found. This mismatch is likely because approximately 96% of Texas is private land, preventing any large-scale searches for migrant remains.[1] Thus, many deceased migrants are found through happenstance. The present research attempts to model migrant movement across Brooks County to better understand where deceased migrants may be found. By incorporating known migrant death locations into the model, this project seeks to improve current search efforts, recovery rates, and the placement of water stations.

Two migration models (Model A and Model B) for Brooks County were generated using ArcGIS® v10.6.1.[2] Cost surface variables include slope, jaggedness, and land use data from the United State Geological Survey (USGS).[3,4] Model A incorporates a cost surface where developed open space is designated as low cost, and all other land use codes are designated as high cost. This surface intends to route migrants through the county by only utilizing open areas, including rural roads and open grassland, and avoiding any moderate to dense vegetation or development. Model A serves as a proxy for easiest movement across the landscape. Model B incorporates a more complex cost surface where cost values are assigned to land use codes based on a theorized compromise between ease of movement and avoidance of detection. Although developed open space is still considered less costly in Model B, shrub/scrub land codes are assigned moderate cost values as it makes moving through the landscape more difficult, while providing camouflage to prevent detection during migration. Two hundred fifty Least Cost Paths (LCPs) were generated from 10 origin points along the southern border of Brooks County to 25 destination points placed along a known pickup road (HWY 285) in the north of the county. Four hundred thirty-seven death locations, obtained from Brooks County Sheriff's Office recovery reports, were then compared to the LCPs from each model.

Near distance analysis of death locations to LCPs suggest Model B more closely approximates how migrants are moving through the landscape in Brooks County when compared to Model A, as indicated by a shorter near distance mean and standard deviation. However, Model A and Model B produce significantly farther distances between death locations and LCPs than when death locations are measured directly to any developed open space code from the original USGS data for the county.

These results suggest that migrant movement across the South Texas landscape is complex, particularly as migrants become dehydrated and disoriented, and that recorded death locations are skewed toward frequently traversed access routes. Continuing research will incorporate hotspot analysis and water station placement to better understand how migrants are interacting with the surrounding landscape. The results of this research can be used by search and recovery teams to develop feasible and efficient strategies that target areas in Brooks County where deaths are more likely to occur. Furthermore, the models that best approximate how migrants are moving through the landscape can be applied to surrounding border counties in an effort to locate and recover more migrant remains.

Reference(s):

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2. ESRI. 2018. ArcGIS 10.6.1. Redlands, CA. Accessed 22 January 2019. https://www.esri.com.
3. Boyce, Geoffrey Alan, Samuel N. Chambers, and Sarah Launius. Bodily inertia and the weaponization of the Sonoran desert in US boundary enforcement: A GIS modeling of migration routes through Arizona's altar valley." *Journal on Migration and Human Security* 7, no. 1 (2019): 23-35.
4. *U.S. Geological Survey, NLCD 2011 Land Cover* (2011 Edition, amended 2014) - National Geospatial Data Asset (NGDA) Land Use Land Cover: U.S. Geological Survey, Sioux Falls, SD. Accessed 12 March 2019. http://www.mrlc.gov.

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