

Towards Humanitarian GIScience: Myriad Maps in an Applied Forensic Humanitarian Context

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Keywords: uncertainty, unidentified human remains, undocumented migration, U.S. Southwestern border, Texas, humanitarian GISci

Introduction

Geographic Information Science (GISci) techniques are increasingly used in forensic humanitarian projects. The ongoing research shared here aims to establish Humanitarian GISci, which is situated at the intersection between geography and forensic anthropology. While geographers tend to focus on human rights monitoring and theorizing an epistemology of applied humanitarianism, forensic anthropologists tend to focus on finding and identifying human remains. The spatial analytical methods, visualization techniques, and tools of GISci, are, in our view, a way of bringing together these disciplines toward the establishment of Humanitarian GISci's formal and empirical framework.

The phenomenon of migrant death at the Texas-Mexico border serves as an example for Humanitarian GISci's implementation. As the U.S.-Mexico border has become increasingly challenging to cross, the number of migrant fatalities has proliferated in remote areas away from traditional ports of entry (Soto & Martínez, 2018). At least 8,000 migrant deaths have been reported on the U.S. side of the border since 1998 (U.S. Customs & Border Patrol, 2021a). However, researchers contend that the deaths are probably much higher, ranging from thousands to tens of thousands (Martínez et al. 2021). Consequently, multiple federal, state, academic, and non-profit institutions, as well as affected families have come together to search and rescue or recover and identify these decedents. Along with these efforts, mapping and GPS sharing have become common practice to launch search and recoveries or maintain forensic case tracking (Humane Borders, 2022).

Currently, most maps that depict the numbers of deaths, dangers of terrain, or geospatial evidence for identification use data from Arizona, the only southwestern border state with longitudinal migrant mortality data and metadata regarding the positional accuracy of remains' recovery location (Giordano & Spradley, 2017). While the use of mapping is recognized in Texas, the data are, for now, insufficient for accomplishing similar spatial statistical analyses at a small scale (Spradley et al., 2019). Since 2012, migrant death in Texas has been high despite a general decrease in undocumented border crossing (U.S. Customs & Border Patrol, 2021b). Unlike other border states, Texas lacks a centralized medical examiner system and, due to private land ownership, there are no regular, systematic search operations. These Texas-specific challenges make it a key area implement Humanitarian GISci to support and advance forensic humanitarian efforts.

Method

The study area, South Texas, is comprised of 10 counties with some of the highest reported migrant mortality incidences 2009-2020. A total of 1,412 records of migrant decedents were obtained from local sheriffs, justices of the peace, and Border Patrol. Additionally, interviews were conducted (n = 52) with local law enforcement and fire department rescue teams, Border Patrol, and local humanitarian organizations between May 2021-July 2021 (IRB7568, 2021). Interviewees were asked to describe how search, rescue, and decedent recovery operations were deployed and discuss the ways mapping informed their work, if at all.

SaTScan® v10.0 and ArcGIS Pro® v2.9.3 were used to examine the spatial and temporal distributions of migrant mortality in South Texas via cluster analyses from the GPS' included in the records. SaTScan was used because it allows for greater control of scan statistic window, thus enabling detection of smaller cluster phenomena such as seasonal trends. Author 1 conducted interviews to juxtapose local knowledge of migrant mortality with traditional GIS, i.e., spatiotemporal analyses in Cartesian coordinate space. Observations and experiences from fire department dive teams and Border Patrol (n = 17) are highlighted in the Results and Discussion section.

Results

The SaTScan space-time scan statistic of South Texas identified seven spatiotemporal clusters (Figure 1, Table 1).

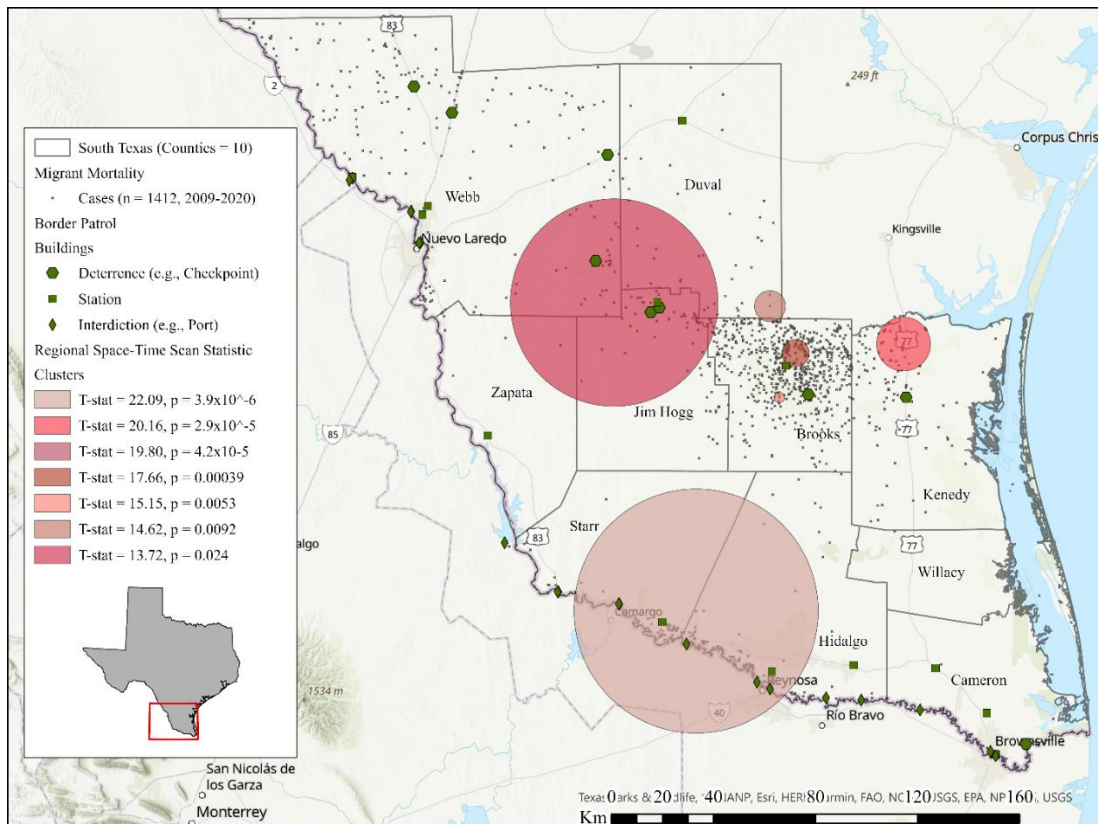


Figure 1: Space-time clusters of migrant mortality hot spots.

Cluster	Date Range (yyyy/mm)	Span (months)	Cases	Test Stat	p-value
1	2016/8 to 2017/8	12	48	22.09	0.0000039
2	2015/12 to 2016/3	4	13	20.16	0.000029
3	2018/1 to 2018/1	1	5	19.80	0.000042
4	2017/11 to 2017/12	2	9	17.66	0.00039
5	2017/6 to 2017/6	1	5	15.15	0.0053
6	2011/6 to 2011/8	3	8	14.62	0.0092
7	2010/6 to 2010/10	5	15	13.72	0.024

Table 1: Space-time scan statistic results for South Texas.

Figure 2 is an exemplar of how local knowledge figured into rescue and recovery work in South Texas. Author 1 accompanied the Mission Fire Department Dive Team on the Rio Grande River and recorded boat put-in sites and where remains were typically found.

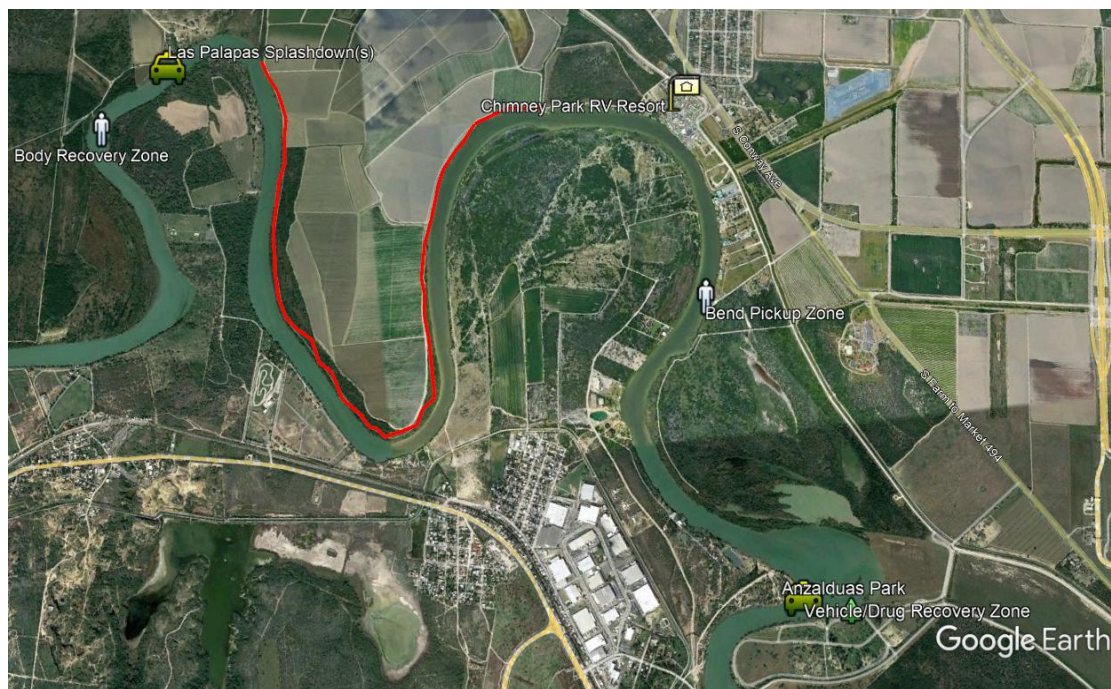


Figure 2: Mission Texas fire department’s dive team of typical rescue and recovery sites in the Rio Grande River

Discussion and Conclusion

We define Humanitarian GISci as the application of spatial analytical perspectives and tools to genocide studies, spatial forensics, and, in general, human rights topics and events (Miranker & Giordano, 2020). Currently, most humanitarian forensic mapping and geospatial analyses focus

on accounting, demonstrating dangers, or informing identifications. The preliminary research shared here is some of the first to represent migrant death in South Texas at a small scale. It is also some of the first to visualize experience of migrant morality from an assisting agency's perspective.

The cluster analysis (Figure 1) demonstrates that summer months tend to have higher death tolls or that the search and recovery of migrant decedents is greater in the summer. Importantly, fatalities occur up to 150 miles inland of the actual border with Mexico. This suggests two likelihoods. Either the peril of environmental exposure to migrants continues after initially crossing the border or that disproportionate search and recovery operations happen away from the border/Rio Grande River in South Texas. Maps such as Figure 2, showcases ongoing (largely) county-led efforts to address migrant decedent cases. Local knowledge of the area informs where and how recoveries proceed as opposed to consultation with maps and spatiotemporal tests. For example, firefighters and Border Patrol know that certain bends in the Rio Grande River tend to have more remains surface on the U.S. side. Interviews with deputies and firefighters affirmed that during search and recovery deployments mapping or GPS collection is effectively a non-priority, while potentially saving a life is. Consequently, a coordinate might represent where a fight department's dive team initially deployed into the river, the spot in the river where someone was retrieved, or when the investigating agent remembered to log a coordinate. In short, there is a great deal of variability in what coordinate locations represent for recorded migrant deaths.

The variability, or uncertainty, in migrant morality coordinate data has negative implications. Map visualizations such as Figure 1 can represent migrant death as normal, a measure of frequency, in the daily activities of law enforcement, emergency service, and Border Patrol. In other words, traditional GIS alone may obscure the extent to which border protective efforts such as deterrence, search and rescue, or remains recovery, are now shared among myriad agencies. Interviews and visualization of local knowledge (Figure 2) show that river related deaths and rescues are common practice because there are known bends where remains typically wash up. However, the responses around migrant death and the degree to which multiple agencies assist one another is obfuscated. For example, Border Patrol depends on its local collaborators such as the Mission Fire Department: "They [Border Patrol] came in and said, 'Hey, we have a dive team, and we want to train with you all to dive these types of waters.' And so we've done it [training and real rescues or recoveries], for Border Patrol or with Border Patrol." Further, Border Patrol tends to get sole credit for river rescues and recoveries, "Border Wars [National Geographic miniseries], every time you saw a car in the water, especially here [Mission, Texas], that was us recovering it. But they only showed the Border Patrol at the end." (IRB7568, 2021). In effect, what is an ongoing humanitarian crisis (Giordano & Spradley, 2017) is not so much being prevented as distributed among multiple agencies in South Texas.

Our findings and continuing research indicate that a mixed method approach to integrate relational geographies (e.g., experiences at the large scale) and spatiotemporal relationships (e.g., trends at the small scale) at once is both necessary and timely. Based on our maps, interviews, and collaborations in South Texas, we propose the following principles as the foundation of Humanitarian GISci: (1) qualitative information is more than ancillary, (2) representing trajectories is informative for forensic and humanitarian actions, (3) and experience(s) associated

with place(s) could engage affected communities and lead to better inclusion of perspectives in humanitarian crises contexts. Relational geography will be integral to sustain applied GISci and other mapping efforts because the context-specific data sources will guide locally specific action(s). What Humanitarian GIS and, in particular, its programmatic qualitative methods, enable researchers to do it trace, map, or relate connections and meanings not readily mappable in a Cartesian Coordinate space.

Acknowledgements:

We would like to thank the SWAAG Field Research Summer Scholarship (2021), PEO Scholar Award (2021-2022), and Texas State Doctoral Research Fellowship (2021-2022). These research and write-up awards have offset the cost of the field research.

We would also like to thank the Forensic Border Coalition, Operation Identification, Argentine Forensic Anthropology Team, and South Texas Human Rights Center. These longstanding collaborations inspired this research. As important, we thank the affected families with whom we have worked with and listened to. Without their activism and input, none of this research would happen.

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