EMERGENCY MANAGEMENT USE CASE

Research Title:	A Web-Based GIS Platform and Applications for Evacuation Preparedness, Response, Mitigation, and Recovery Planning: The Texas Hazard Resilience Atlases
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Description:	The origin of this *EM Use Case* stems from two completed Hurricane Evacuation Studies funded by FEMA/US Army Corp of Engineering in the Rio Grande Valley and Coastal Bend Hurricane Study areas. In addition to updating evacuation zones based on recent hazard data and conducting extensive evacuation traffic studies, these projects funded the development of two web-based GIS platforms and applications facilitating evacuation planning, evacuation zone development, and comprehensive vulnerability analyses for EM organizations and project participants. These platforms provide extensive data on hazards, infrastructure, critical facilities, population and household socio-demographic and socio-economic data, job locations, residential (single family, multi-family, mobile home) and commercial structures, transportation infrastructure, hotels/motels, ISDs, etc. as well as analysis tools and summary data critical for physical and social vulnerability analyses. The data include those specifically generated by the research team as well as data gathered from local, state, and federal sources. Tools include mapping and analysis tools for areas and key points of interests. The websites were designed with low-resourced EM organizations, VOADs, and other stakeholders providing the data and tools necessary to undertake extensive vulnerability and impact analyses without requiring extensive data holdings, computer equipment, specialists, etc. For higher resourced communities, the platforms provide a convenient solution for analyses that can be done on the fly on a laptop, pad, and in some situations, on their smartphones. More importantly, via the data portal, all data can be downloaded and incorporated into their own systems to refine analyses further. While developed for evacuation preparedness and response, the platforms and applications were also designed to facilitate mitigation and recovery planning. Working with TDEM and EM practitioners, we will enhance and improve the utility, tools, and analyses of these atlases.
When Applied:	The atlases can be employed for evacuation preparedness and response, mitigation, and recovery planning. It is possible that more timely post event data – such as post disaster damage assessment, permit data, funding data, displacement, closures/reopening, etc. could be incorporated to facilitate recovery monitoring and assessment.
Who Applies:	Local and state EM organizations, local response, planning, and community services departments, VOADs and other organizations interested in all phases of disaster response as well as those addressing chronic problems of housing, food security, special needs populations, etc.
Disaster Type:	Hurricanes, tropical storms, coastal and inland flooding, extreme climate events, wildfires, etc.
Infrastructure Affected:	Features and dimensions of the built environment such as residential and commercial structures, critical facilities, highly vulnerable residential structures such as mobile homes, transportation infrastructure, etc.
Industry Affected:	Vulnerabilities/hazard exposure of all economic activities (jobs), elements of the built environment including residential, commercial, industrial/manufacturing, and retail commercial buildings, their footprint, and in many cases their economic values for potential loss

	assessments are available. Similarly infrastructure upon which all depend are available to again visualize their potential exposures/vulnerabilities.
Where Applied:	Currently the two atlases for this project include all counties (and their municipalities, communities, and colonias) in the Rio Grande Valley Hurricane Study Area (Willacy and Cameron counties) and in the Coastal Bend (Aransas, Calhoun, Kleberg, Nueces, Refugio, San Patricio and Victoria Counties).
Agency Affected:	The target *Use Case* agencies would be county and municipal EM organizations, county/municipal planning agencies/departments involved in transportation, mitigation, housing, public health, disability services, and community planning, floodplain management agencies, housing authorities, local school districts, COGS, and stakeholder organizations.
VOAD Affected:	VOADs are a prime example of stakeholder organizations that would find these atlases useful for planning activities. The data will allow them to identify key areas with highly socially and economically vulnerable populations that are also in areas subject to high hazard exposure and vulnerabilities.
Who/What Affected:	State, regional, and local EM agencies, local planning departments, VOADs, social service organizations, Food banks, etc.
How Affected:	This Use Case project should, after working with our EM practitioners enhance the utility and visibility of these atlases for communities & counties enabling all EM organizations, planning organizations, and key stakeholders groups (such as VOADs), particularly among lower resources communities and groups to utilize the freely accessible GIS web-based platform to better understand and visualize their physical, social, and economic vulnerabilities to a variety of natural hazards. Having this ability could enable improved planning as well as an improved understanding of needs for effective evacuation, mitigation, and recovery planning. It can also help to avoid unnecessary evacuations, thereby reducing highway congestion, easing overcrowding at local storm shelters, and boosting public safety. Even for the broader public that might not fully engage with the platform's full capabilities, on the front page of each atlas, individuals from each area can enter their address, or the address of their family members, and identify what, if any, evacuation zone they are located in which can help their understand of their hurricane surge risk. Knowing their location can help householders better understand potential impacts from a storm's likely landfall.
Timing of Application:	The Atlases are specifically designed to facilitate pre-event evacuation preparedness, response, mitigation, and recovery planning. The goal is to provide data layers, tools and analyses, to facilitate comprehensive physical and social vulnerability analysis to guide and shape broad based hazard and disaster planning across phases.
Critical Points:	These atlases provide the opportunity for users, particularly stakeholders in lower resourced areas or organizations, to undertake analysis based on linking natural hazard exposure/risk data (i.e., hurricane surge, wind fields, inland flooding), with built environment data (i.e., residential structures/homes, commercial, transportation, critical facilities), and socio-demographic and economic data on populations (individuals, households, and families) to undertake detailed, high-resolution analyses to enhance a variety of forms of evacuation, mitigation, recovery and restoration planning. Additionally, these data can be utilized to develop and justify grant proposals to federal and state agencies for not only disaster/hazard related, but for housing, infrastructure, and other community needs. For example, we include the HUD classification Low

	to Moderate Income measures by census block-group on these atlases which can help local areas meet CDBG grant qualification.
What Benefit:	The platforms, tools, and data put powerful GIS data and tools into the hands of local organizations and stakeholder groups that may not otherwise have the resources nor data capabilities that larger, well resourced organizations have to undertake broad based vulnerability analyses to facilitate EM planning processes across disaster phases. Indeed, these platforms provide the ability to overlap and analyze data helping stakeholder better identify and understand community hazard & and vulnerability hotspots such as problem areas where highly vulnerable populations or critical facilities converge with high hazard areas. In addition, local citizens can map their home and job locations relative to evacuation zones, surge, floodplains, wind fields, etc. Activities on the website, usage, data downloads, etc. can be monitored to assess usage.
Where Used:	Web-based platforms can be used by anyone with a laptop, tablet, or similar mobile device.
Additional Research:	A proof of concept application has been built which affirms capability to estimate frequencies (counts) of specific population subgroups (e.g. single parent households, elder households in poverty, population without vehicles) in selected areas. Development of more robust selection tools for analysis of targeted areas represents a potential area of research. In addition, identification of new individual/household data, characteristics, or indices (e.g. Internet access, insurance, etc.) as well as the new Community Resilience Estimates from the U.S. Census could be included in the atlases.
Additional Information:	A full set of weblinks on the projects, reports, maps, atlases, etc. are provided below. There are also peer reviewed articles upon which much of the work is based. Additionally there is a book, directed at the user/practitioner community that discusses approaches to using these atlases to promote broad based resilience planning by communities: Masterson, J.H., W.G Peacock, S. Van Zandt, H. Grover, L. Field Schwarz, and J. Cooper, Jr. 2014. *Planning for Community Resilience: A Handbook for Reducing Vulnerability to Disasters*. Island Press: Washington D.C. Paper ISBN: 9781610915854. https://islandpress.org/books/planning-community-resilience
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Original Research:	The following provides links to the Coastal Bend and Rio Grande Valley Hurricane Evacuation Study 1) project website, 2) atlases, and 3) the vulnerability analysis reports that explains the operation and data of each Atlas. Additionally there is a link to the data portal. The latter is a website design for agencies that have their own GIS resources and simply want to access the data. The project websites also provide PDFs of various resolutions for evacuation zone maps, traffic study reports, evacuation zone reports and in the case of the Coastal Bend project, a report on behavioral survey conducted as part of the study.
	
	 Portal for both projects, on the Hazard Reduction and Recovery Center's website: Here
	
	    1. Coastal Bend Hurricane Evacuation Project: Here
	      a. Link to the Coastal Bend Atlas: Here
	      b. Link to Vulnerability Analysis Report: Here
	
	    2. Rio Grande Valley Hurricane Evacuation Project: Here
	      a. link to the Atlas: Here

	b. Link to Vulnerability Analysis Report: Here 3. Link to Open Data Portal for both websites and additional documentation: Here
What Risks:	The only potential risk is associated with the data becoming outdated and lacking currency as a consequence.
Partner Agencies/Jurisdictions:	Emergency and disaster management practitioners in coastal zones, as well as planners and responders statewide who can use response-relevant information about hazards and vulnerable areas, transportation, infrastructure, and vulnerable and at-risk populations (elderly, transportation limited, medical needs, limited english, etc.) and their locations. Participants in the completed projects were from local agencies in Cameron, Hidalgo, Willacy, Kenedy, Kleberg, Jim Wells, Nueces, San Patricio, Bee, Aransas, Refugio, Victoria, Calhoun and Jackson Counties and their municipalities, including emergency management, law enforcement, fire, emergency medical, and other community services; councils of government; state agencies including TDEM, TXDOT, DPS-THP Texas Sea Grant, and Universities; and federal agencies including FEMA, USACE, NOAA-NWS, and DOD; and community/volunteer organizations.
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Research with a Technology Component Should Respond to the Following Questions

Research Requested:	Yes; local EM organizations need updated evacuation planning and response information (evacuation zone reassessment, traffic analyses, and vulnerability analyses) based on the newest hazards, transportation, and population/built environment/development data. FEMA/USACE are pressured for new updates. For example, the Houston/Galveston area has been contacting and pressuring FEMA/USACE to begin updating the outdated previous Hurricane Evacuation study for their area. This use case would update and broaden the use of already completed research projects.
Why Better:	A primary reason is that the website, mapping, and analysis tools are web-based and do not demand that local agencies, VOADs, or other stakeholder organizations have extensive data systems, computer systems, expertise, GIS packages, etc. These web-based platforms are free and data are more recent, based on updated data analyses that are both reliable and valid.
Reliability:	Atlas geodatabase services operate on Texas A&M cloud-based systems managed by ESRI, which are designed and managed for high reliability. ArcGIS Online is a secured, reliable geographic information system (GIS) delivered using the software-as-a-service (SaaS) model. Online services are elastic, available on demand, managed by ESRI, and accessed by a client running on a wide range of options, including laptops, tablets, and smartphones. Reliability is also dependent on user-side access to the Internet.
Support Needed:	Basic needs would be internet access (faster the better) and laptop or desktop computer. Access to a printer may be useful, although generating PDF is possible.

Citizen Impact:	No potential negative impact as long as users are warned and made clear that mapping services/locations are approximate and modeling disclaimers are acknowledged by users.
Training Required:	For a person with no experience with GIS, some initial training is necessary. We have and could provide training in the future. For example, we have recorded and used online video sharing and social media platforms such as YouTube (i.e. https://youtube.com/watch?v=GjoDqNYnjLc&t=1005). We can provide training in English or Spanish. In the future, the creation of training modules, extracting and developing training documentation from the vulnerability reports would enhance and facilitate usage by more novice stakeholders.
Public Accountability:	All data provided on the Atlases are publicly available through local, state, and federal agencies. Data generated by the HRRC researchers were authorized though University IRB processes, and supported by a variety of funding agencies, are provided in open access format (requesting citation) and the basic research has been vetted through peer review processes.

Please Note: Questions or suggestions regarding the Use Case Template may be directed to Dr. MacGregor Stephenson at the Texas Division of Emergency Management at macgregor.stephenson@tdem.texas.gov.