

Flooding in Houston, Texas, in the US after Hurricane Harvey hit in 2017



THE NEW NORMAL

WITH NATURAL DISASTERS INCREASING IN NUMBER AND INTENSITY EVERY YEAR, GOVERNMENTS AROUND THE WORLD WILL HAVE TO USE LOCATION INTELLIGENCE AND SPATIAL ANALYTICS TO ADJUST TO 'THE NEW NORMAL' AND SAVE LIVES, SAYS RYAN LANCIOS

Between August and October of 2017, parts of the southern United States, Mexico and the Caribbean were beset by a series of natural disasters that seemed to occur in relentless succession. Three category four hurricanes struck the US in less than a month: Hurricane Harvey in Texas, Hurricane Irma in Florida, and Hurricane Maria in Puerto Rico and the US Virgin Islands. Additionally, a 7.1 magnitude earthquake hit Puebla, Mexico, about 129km east of Mexico City.

Responding to successive crises can be overwhelming for local governments. Disasters

of this magnitude result in incomparably widescale damage. For communities to respond and recover effectively, good preparation and hazard mitigation are crucial. A key component of this work is the element of location – where hazards exist, where the community is most vulnerable and where resources are needed most. And when it comes to response, first-responders rely on accurate location data to save lives and property. Location intelligence has helped the communities most affected by the recent hurricanes and earthquake. Using spatial

analytics technology, they have been able to make better decisions about where to target relief and improve their infrastructure for the future when disaster strikes again.

Thinking ahead for the unthinkable
Communities dealing with natural disasters need to understand their risk and know which areas are most vulnerable to better prepare. By mapping and analysing where hazards, people and infrastructure intersect, a community can prioritise mitigation strategies and determine where to begin preparations before a disaster even strikes.



The city of Key West, Florida, used spatial analytics to assess the city's flood vulnerability and determined the steps it should take to reduce this vulnerability. With flood insurance rates constantly on the rise, Key West sought discounts from the Federal Emergency Management Agency (FEMA), the federal agency in charge of disaster response resource coordination in the US. FEMA's Community Rating System (CRS) recognises and encourages community floodplain management activities that exceed the US's National Flood Insurance Program's minimum standards by reducing insurance premium rates for communities that qualify. Key West mapped the footprints for each of its 11,000 buildings. This data was then used to supplement the city's other information to provide a detailed view recording damage caused by the storm, securing a 15% reduction in flood insurance premiums for both the city and its citizens.

After the storm

In the immediate aftermath of large-scale natural disasters, decision-makers need to know who and what have been affected. Without accurate insight into the scale and scope of an incident, government agencies have little way of understanding which resources to deploy and where to send them to have the greatest impact.

For example, the Central Mexico earthquake that hit on 19 September 2017, caused rampant property destruction, with hundreds dead and thousands injured. While earthquakes come suddenly and are almost impossible to predict with any meaningful accuracy, the ability to respond with precision is paramount.

Esri quickly created an impact summary map highlighting the locations most affected by the earthquake. This was done using Esri's Enrich Layer, which provides demographic

DECISION-MAKERS NEED TO KNOW WHO AND WHAT HAVE BEEN AFFECTED

Once the disaster occurs and response is under way, knowing where resources are located and managing their use is one of the biggest challenges for agencies. This means mapping not only resource locations as they are deployed for response and recovery but also community resources such as shelters and disaster recovery centres. Sharing open shelter information with the public can reduce panic during an evacuation. Information, such as points of distribution for drinking water, food, and other resources, is critical if the community's distribution system is knocked out or homes are damaged or destroyed and citizens need supplies. For vulnerable populations that rely on certain medications or medical treatments in their daily life, helping them find the necessary medical resources could mean the difference between life and death.

information of people and regions, and uses Esri Geo Enrichment Service to integrate information about residential areas and businesses. The impact of an earthquake was mapped in Modified Mercalli Intensity (MMI) seismic scale, which has four bands showing the intensity and the range of impact. The map could be zoomed in and out to focus on specified coordinates, and everything from housing areas to community centres to shopping complexes could be searched in seconds. Specifically, the map showed the impact of the earthquake on nearby populations based on its severity. The United States Geological Survey (USGS) shake map provided the extent and magnitude of shaking around the epicentre of the earthquake, with four colours used to distinguish the severity of the shaking.



Direct Relief is a non-profit, humanitarian aid organisation with a mission to improve the health and lives of people affected by poverty or emergencies. Before a storm hits, Direct Relief uses demographic information to analyse different factors that can contribute to populations being more vulnerable to disasters. During extreme weather disasters such as Harvey, the heaviest price is usually borne by the most vulnerable communities in lower income areas in cities that are often located in the path of the watershed.

Before Harvey made landfall in Houston, Texas, Direct Relief created a map that showed the precise location of these flood-prone areas in the city, informing decisions about how to help citizens most effectively. But understanding areas of high vulnerability can be valuable in ways that extend beyond mitigating the effects of disaster.

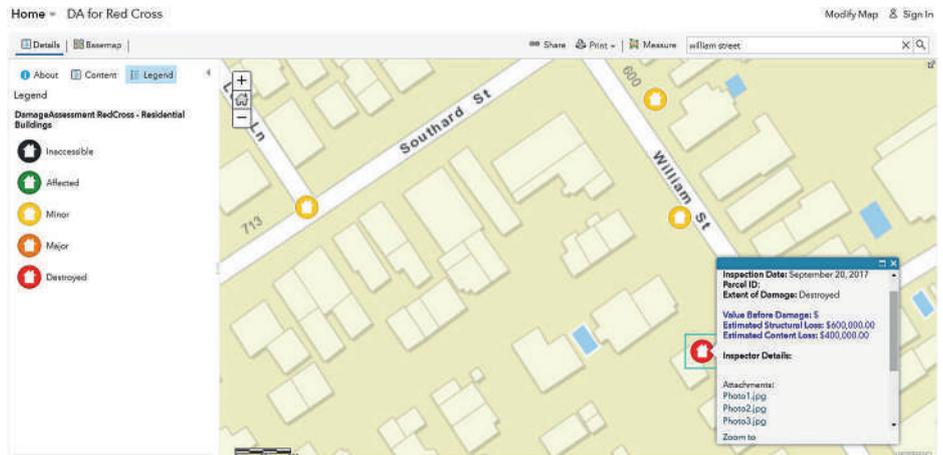


The impact summary map created by Esri highlighting the locations in Mexico most affected by the earthquake

EMERGENCY MANAGEMENT

The interactive impact summary map could be zoomed in and out to focus on a specified location, and everything from housing areas to community centres to shopping complexes could be identified in seconds. By saving time during rescue operations, the map ensured that more lives could be saved.

Validating the impact takes time and effort, and conducting a formal post-event damage assessment is a critical step in the process. The quicker this is completed, the better, as damage assessment information is needed to request a disaster declaration that can offer much needed assistance to the community. Key West's emergency operations centre (EOC) prepared mobile damage assessment collection tools on their smartphones during



Esri prepared apps that assessed damage to property as well as debris for the city of Key West after Hurricane Irma hit

ARMED WITH THESE NEW TOOLS, FIRST-RESPONDERS CAN BE MORE PREPARED THAN EVER BEFORE

the hours leading up to Hurricane Irma's landfall, in anticipation of the need to expedite the process. These Esri-powered spatial analytics tools tracked the toll of the hurricane after it passed.

By 11 September 2017, the winds had died down enough for EOC staff to inspect outside. The island residents who chose to remain had no power, water, internet, petrol or phone service, and very little food.

The new mobile damage assessment app created by EOC was used to conduct a rapid windshield survey. This initial damage assessment established benchmarks for degree of damage and insurance coverage and is required by FEMA to determine whether a federal disaster declaration is warranted. Since EOC had downloaded map data to the



The southernmost point of Key West, which was damaged by Hurricane Irma

mobile app before Irma hit the shore, it could immediately begin collecting data with no internet connection.

Twelve teams from the city collected data using Esri's Collector for ArcGIS on their phones or tablets, which allowed them to drop a pin on a map, detail the damage and add photos. When communications and power were down, this data was collected offline in the field and synced at the end of each day back in the office where limited communications were available. When communications were restored, the data being collected in the field provided city managers a running tally of damage on an operations dashboard, as well as a real-time view of the progress of the data collection teams.

Because of this collection effort, Key West received word from FEMA that it had enough detailed documentation of the damage that the president would declare a major disaster

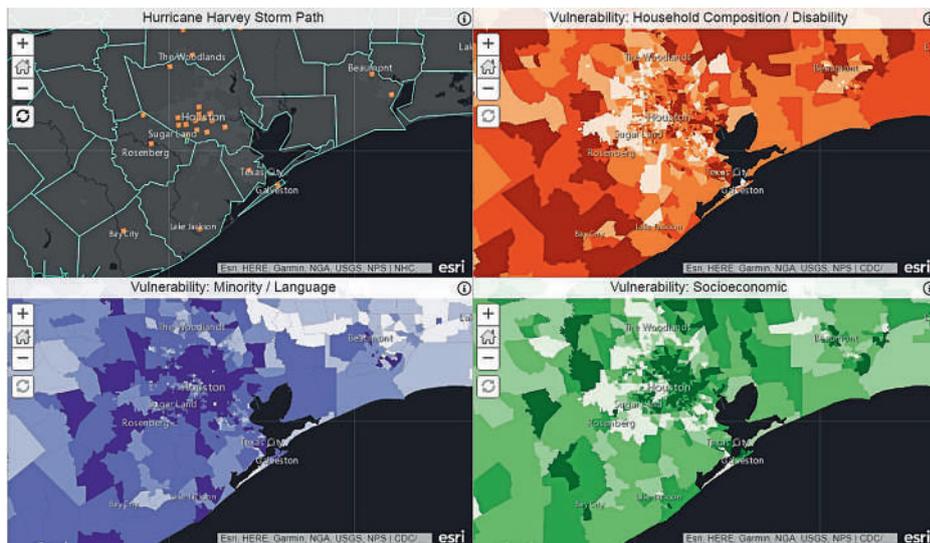
for the city – meaning that federal funds for assistance would be made available to the government as well as individuals. Key West received funds for debris removal, emergency protective measures, and to repair roads, bridges, water control facilities, buildings, equipment, utilities, and parks and recreation facilities.

The damage assessment map produced by these mobile tools allowed the city to document and prioritise all the repair work that needed to be done. This data was also publicly available online and used extensively by evacuees who had not been able to return to the city, as well as by the American Red Cross to identify emergency relief needs.

Prepared for the new normal

Newer forms of technology are often left out of the disaster preparedness conversation, and organisations historically rely more on institutional knowledge and instinct when responding to incidents. But institutional knowledge can be surpassed as events such as hurricanes and wildfires increase in frequency and reach levels of intensity never seen before. Emergency management agencies must find a way to build on existing knowledge and prepare for the new normal.

Location intelligence provides a way to better prepare and respond. Traffic sensors, cameras, stream gauges, weather stations, air quality monitors, and even smart assets such as streetlights and rubbish bins provide real-time data that can be leveraged to drive action. By



The vulnerability zones map shows how different areas are more vulnerable to the effects of a hurricane due to factors like low income or lack of mobility.

connecting to these sensors and exploiting the location element in this digital network, communities can act on real-time information. Having data recorded in the location where it occurs in real-time, which can then be integrated into a location intelligence platform, enables a map to be more useful.

One example of this is a utility company that has remote sensors monitoring gas pipelines for leaks during earthquakes or other disasters. It will know the instant the leak occurs to send personnel to the site for repairs, before more dangerous damage is incurred. Or, in another instance, resources can be proactively

dispatched and citizens alerted in an area prone to flooding or wildfires, based on changing weather conditions.

Armed with these new tools, first-responders can be more prepared than ever before. For those who work in public safety, this digital transformation presents an amazing opportunity to build safer communities. And the more prepared we are to face the new normal, the more resilient we are when disaster strikes.

Ryan Lanclos is director of public safety industries at Esri (www.esri.com)



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