Web-Based GIS Helps "City of Trees" Recover

Buffalo, New York, Urban Tree Management Evolves from Surprise Storm

Highlights

- Errors caused by lack of information or delayed communication are prevented.
- Real-time display of completed work helps decison makers.
- Program saves the city money, which is being used to plant new trees.

On October 13, 2006, a historic lake-effect snowstorm surprised the city of Buffalo, New York, dumping more than two feet of snow overnight. Two days later, president George W. Bush issued a major disaster declaration for the city and surrounding areas. Federal aid was made available to assist in recovery efforts.

The tree management Web-based GIS allowed full editable access to instantly update tree records and complaint information.

Located on the northeast shore of Lake Erie, Buffalo sees an average of more than 93 inches of snow each year. This particular storm event was unique because it happened in early October; most major snowfall does not occur until late November or early December. As a result of this snowstorm, there was widespread damage to roughly 85 percent of the area's trees. This damage was a result of vertical snow loading on fully canopied trees, causing limbs to structurally fail. The falling branches caused excessive damage to cars, houses, and power lines, leaving nearly 400,000 residents in more than 100,000 homes without power for several days.

Known as the "City of Trees," the city of Buffalo has maintained a complete urban forest inventory since 2001. This inventory includes all city-owned trees that reside in the public rights-of-way between the curb and sidewalk and also all trees in the city parks. There are 68,000 trees and 108,000 locations included in the tree inventory.

After the October storm and the initial clearing of fallen trees and tree branches from the

roadways, the city started assessing the condition of the urban forest. Within the first few days after the storm, the city realized that a new system would have to be implemented to assess and inventory all damaged trees throughout the city. The existing tree inventory management system in place at the time of the storm was not capable of supporting the effort needed to assess and update the inventory on such a large scale. Before the October storm, many of the tasks needed to manage the tree inventory were completed using a paper-based system involving the use of paper tickets. Hours of data entry into a central database was necessary after information was recorded on paper forms out in the field. Another consideration for the development of a new system was to improve the city's chances to qualify and receive maximum funding from the Federal Emergency Management Agency (FEMA) for the several-month-long poststorm cleanup effort.

Urban Forest Specialists and GIS Professionals

Wendel Duchscherer Architects & Engineers, with headquarters in Amherst, New York, has been the city's urban forest manager since 2005, responsible for day-to-day maintenance and management of the tree inventory. This includes the issuance and management of annual trimming, planting, and removal contracts; handling citizen complaints regarding street trees; inspecting contractor work; and inspecting and updating information on each individual street tree in the inventory.

The city's tree population was devastated by the surprise storm. This shows one of the many city streets blocked by fallen tree limbs.

The firm's urban forest specialists and GIS professionals collaborated to develop a GIS-based tree management program to answer the urgent and comprehensive needs of the city resulting from the weather disaster. The program was called Urban ForesTREE Management and was developed utilizing a combination of ArcGIS Server and ArcIMS technologies. When the initial development started two weeks after the storm, four separate groups were identified as primary users of the program: contractors, inspectors, city officials, and the urban forest manager. Each group had a customized Web-based GIS site developed to fit the particular needs and requirements of the work that was completed. By having each site use the same central database, work that was completed on one group's site instantly updated the information on the other three sites. This prevented errors caused by lack of information or delaying communication to the decision makers.

The first task after the storm cleanup was to inventory all the damaged trees of the 68,000 existing trees owned by the city. An ArcIMS application was developed by Wendel Duchscherer to run on a Pocket PC that inspectors used in the field to enter data. One of the main considerations when development started was the elimination of paper forms. These forms were re-created as editable Active Server Page (ASP) forms and integrated into the ArcIMS site. This not only helped the field-workers with organization, it also eliminated the need for office personnel to enter the data into the central database. General reference layers (e.g., parcels, aerial photography, roads) were added to the application to help inspectors reference their location when in the field. Through this application, inspectors were able to

select a tree on the map and enter updated information directly into the central database. There were up to 10 inspectors in the field at one time after the storm. Another benefit of this system was the real-time display of completed work. Project decision makers and city officials were able to view daily progress and all detailed field information.

Once the damaged trees were assessed, they were added to either trimming or removal contracts. The firm then developed another ArcIMS application to help contractors mobilize their crews and track and locate the trees on each particular contract. Organization of the individual contractor information was critical, as more than 100 field crews were working throughout the city at any one time. The ArcIMS site provided the contractors with a map and list of the trees for each of their individual contracts. When work on a tree was completed, the contractor was able to request inspection of the tree through the Web site; the inspection request would be instantly added to the Web application, allowing inspectors already mobilized in the field to visit and inspect completed work sites on a more timely basis. This not only automated the scheduling and work assignments for the inspectors but also expedited the verification and payment process for the contractors.

The most complex parts of managing the city of Buffalo's urban forest is editing tree locations and attributes, along with handling complaints submitted by the public. Wendel Duchscherer developed an ArcGIS Web Mapping Application (WMA) designed to efficiently meet these challenges. The urban forest manager needs the ability to edit the location and associated attributes of every tree in the inventory. A tree information tool allows viewing and editing of each tree simply by selecting the tree through the mapping interface. Individual trees can also be added to selected contracts while in the field, eliminating the need to create the contract information at a later time.

Detailed view of customized ASP Web forms allowing updates while out in the field.

The city's Web site has a citizen Call and Resolution Center where residents can submit complaints related to city services. Any complaints about city trees are entered into the system by geocoding the address entered on the Web complaint form. These geocoded locations are populated on the WMA site through a nightly automation process. A custom tool was developed that allows the urban forest manager to select an individual complaint and enter the various attributes recorded for response to the complaint.

The October storm caused unprecedented damage to the city of Buffalo's tree population and, at the same time, changed the management of its urban forest. The GIS-based Urban ForesTREE Management program now provides the city with an innovative system to manage and maintain its urban forest more effectively and efficiently than ever—and saves the city money, which is being reallocated to repopulate the trees that were lost as a result of the storm.

More Information

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