

COVID, Murder Hornets and Wildfires – Oh My!

Harnessing the power of GIS to manage statewide crises

State: Washington state

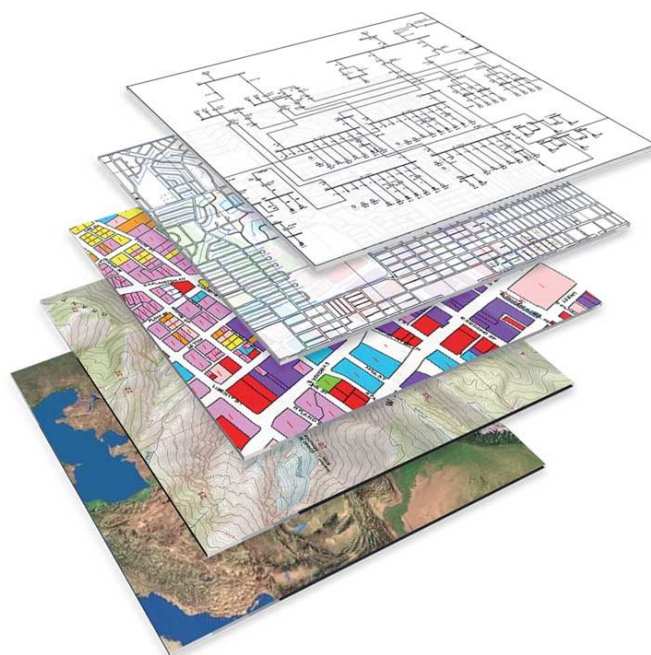
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Harnessing the power of GIS to manage statewide crises

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Executive summary

Once considered an interesting, but unproven, technology relegated to information technology's sidelines, geographic information systems (GIS) has moved front and center for organizations. It now plays a central role in addressing critical environmental issues, improving business processes and elevating the citizen experience.

GIS systems are not only used in Washington state daily to provide information about traffic jams, land-use patterns, mapping locations and more, but are crucial in capturing the data needed to manage statewide crises like COVID-19, wildfires, or to track murder hornets.

With the onset of the pandemic in 2020, the Washington State Geospatial Program Office embarked into new territory, mapping real time information on COVID-19 cases, hospital admissions, vaccinations, and deaths in a way that decision makers and the public could understand.

As the COVID-19 pandemic continued to spread across the state, nation and globe, government officials and citizens turned to maps to make sense of uncertainty, to focus and target response efforts, to provide a platform for collaboration, and to monitor and adapt to rapidly changing environmental conditions.

Geospatial information was crucial in the early stages of the pandemic for state response efforts. Maps and applications were created in real time to adjust to information needs from working with epidemiologists to map the spread of COVID-19, to locations of public Wi-Fi access for people working remotely, childcare for first responders and identifying supplies of personal protective equipment.

Washington state also encountered the first-ever sightings of the Asian Giant Hornet (aka 'murder hornet') in the United States. The effort to find and ultimately eradicate the only known nest of hornets, (destroying 190 larvae, 112 workers and 76 queens) involved an innovative use of technology that showcased the power of GIS by enlisting 380 citizen scientists who placed and monitored more than 2,000 live hornet traps for months at a time and registered their traps using a custom web-based mapping application. This information was automatically updated on a GIS system allowing the state to narrow down where the hornets live and ultimately following a live hornet by tying a small transmitter to it with dental floss until the nest was located.

In summer 2021, GIS was used to track more than a thousand wildfires burning over 713,000 acres statewide using a publicly available, mobile-friendly map-driven web application providing users with a single source of current wildfire information compiled from all six DNR and interagency dispatch offices. Tapping into data feeds from the other interagency partners this solution provided situational awareness and focused on real-time intelligence from all available sources through the wildfire dashboard.

Harnessing the power of 'where', Washington state GIS further supports and confirms the role of data and information management for sustained access to government services, informed decision-making, implementing innovative IT solutions and improving the delivery of government services to citizens to manage statewide crises.

Moving forward, the Washington State Geospatial Program Office is developing a legislatively mandated common data-sharing platform for public organizations in Washington to host and share sensitive natural hazards mitigation geospatial data. Currently, there is no common platform for state, local and higher-education organizations to share existing state geospatial data on natural hazards risks.

The GIS Natural Hazards Mitigation project will provide consistent natural hazards data for use by state, local and higher-education organizations to support state hazard risks and resilience mapping and analysis. Legislation has identified \$724,000 in funding to create this common platform and has established an expectation for the data platform to be available by June 30, 2023.

Harnessing the power of 'where'



In times of crisis, the greatest need to address in an emergency is the ability to collect and apply data and information. GIS serves an integral part of the entire comprehensive preparedness, response and recovery system as a source of real-time information crucial to assessing the size and extent of damage, reconstruction and public awareness.

With the onset of the pandemic in 2020, the Washington State Geospatial Program Office embarked into new territory, mapping real time information on COVID-19 cases, hospital admissions, vaccinations, and fatalities in a way that decision makers and the public could understand. The main critical business problem to address with the pandemic (and other crises) was determining 'the where' - where the pandemic was spreading, where affected people are, where to find resources and services to help, etc. GIS is at the core of 'harnessing the where' and how government can use this data to respond to a situation, individuals, neighborhoods, communities, and more.

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Geospatial information was crucial in the early stage of the pandemic for state response efforts. Maps and applications were created in real time to adjust to information needs from working with epidemiologists to map the spread of COVID-19, to locations of public Wi-Fi access for people working remotely, childcare for first responders and identifying supplies of personal protective equipment.

GIS improves the business process as a component of decision-making in a crisis. For government, it provides the ability to not just use maps for emergency preparedness and response services, but also for communicating with, and targeting messages to, residents such as mapping locations of publicly available Wi-Fi sites to support telemedicine, remote work and distance learning as well as food bank and childcare locations for essential workers. The unknown duration also forces government to evaluate economic impact and enable business continuity.

For residents, they are primarily concerned about themselves, their environment, neighborhood, community, etc. GIS provides the ability to calculate the risk residents are exposing themselves or others to, help locate essential resources and services, monitor health statistics on a public dashboard and more.

From a national perspective, harnessing the power of GIS to manage a statewide crisis further supports and confirms the role of data and information management for sustained access to government services, informed decision-making, implementing innovative IT solutions and improving the delivery of government services to citizens.



COVID: Collaboration and the cloud

What COVID-19 has proved to everyone is that we had to find better ways to communicate, not only through chat or video, but also in the sharing of complex data.

Led by the Washington State Geospatial Program Office, state GIS systems and initiatives are supported at the enterprise level to provide open data leadership, guidance, policy direction, and oversight within state government. The office works closely with GIS departments throughout Washington state agencies to provide both partners and constituents with the geospatial information they require to make informed decisions.

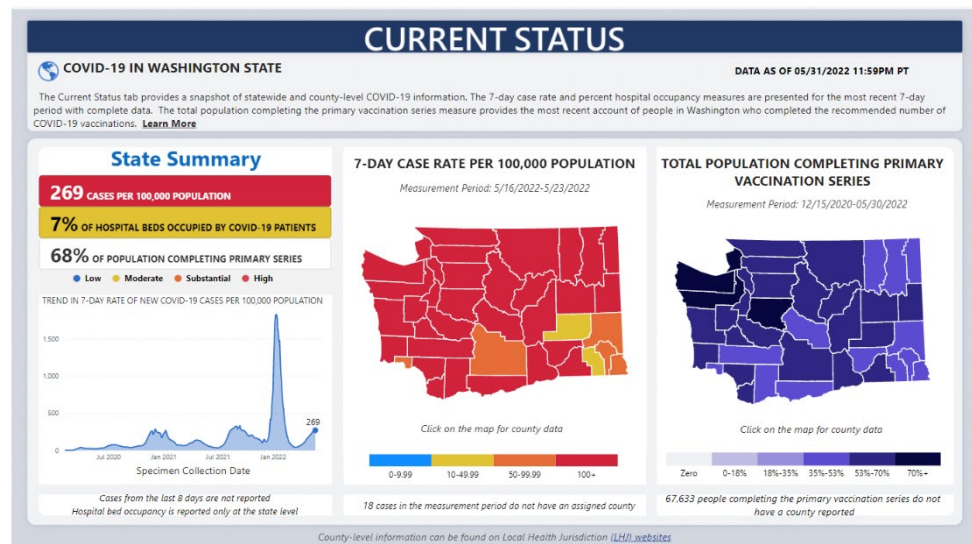
In the case of managing an unprecedented global pandemic, Washington state was prepared for the challenge because of the well-established interagency cooperation and the ability to collaborate statewide to find solutions. Sharing of independent agency data to a cloud-based online portal – geo.wa.gov – was the key to expediting knowledge/data transfer during the early ‘frenzy’ of the pandemic and as it progressed. This established process is further supported by the state GIS governance team consisting of GIS managers, agency CIOs and technical staff from over 30 state agencies. This governance structure supports and manages geospatial resources within agencies and across state government.

Because crises rarely impact just one or two organizations, the Washington State Geospatial Program Office takes a global view of the situation and how to address it. As a federated state, it takes a significant amount of cooperation and collaboration among the state agencies on the GIS governance team to pull together all the diverse data and information needed, consolidate it and share it in a transparent, global and useful way.

From the technical side, ESRI and Microsoft provided the support necessary for emergency management operations and response. ESRI provided the GIS software (ArcGIS – SaaS mapping platform) that supplied the location data for PPE, childcare locations for essential workers, publicly available Wi-Fi sites, food banks and more. They generously supplied unlimited users for the SaaS solution and provided resource assistance services to help rough out applications.

Leveraging Microsoft Azure virtual servers and PowerBI, state Department of Health (DOH) statistical information was converted to an easy-to-view geographical format with nearly real-time COVID-19 data, displayed by county. The Washington State Military Department worked with Microsoft to set up a data lake with shared drives on Azure. This made it easier to share information with other state agencies as well as with remote workers who would have been at the state Emergency Operations Center at Camp Murray.

ESRI provided the software that was installed on Azure virtual servers for a more secure platform to store confidential and private data that couldn't be shared publicly. All this was done in a remote environment which was crucial during the pandemic.



The power of GIS

The pandemic showed the power of maps and as people became more aware of its utility, state agencies began incorporating it into their planning to make more informed decisions and improve services to Washingtonians.

The widespread use of GIS for COVID-19 response has demonstrated the power of geospatial thinking and the scalability, speed, and insight provided by GIS. It has proven to be more than simply a mapping tool, using geography to aid in the pandemic response in bringing information to light for government and residents alike.

BY THE NUMBERS – COVID RESPONSE

Development of more than **50 maps, 52 applications** and **75 data sets** to support emergency management operations and response.

Mapping locations of **publicly available Wi-Fi sites** to support telemedicine, remote work and distance learning as well as **food bank and childcare locations for essential workers.**

Eradicating the first-ever Asian giant hornet nest in the U.S. using GIS

Although the introduction of the Asian giant hornet was a first within the United States, the playbook to survey, detect, delimit and eradicate the invasive pest is one carried out by the Washington State Department of Agriculture (WSDA) Pest Program each year. At the core of each step of the process are quality GIS datasets, tools, and web-based desktop and mobile mapping applications.

During the initial design phase for WSDA's trapping survey response, known maximum foraging distance buffers were drawn along with high-density grids to aid trappers in trap-placement efficiency and ensure proper trapping coverage around detections. These mapping tools also allowed the WSDA to work on outreach to tap into a groundswell of support and used internal maps to find areas where citizen scientists could place traps easily and effectively using GIS web-based trap placement reporting forms. WSDA also

Using GIS to track a murder hornet

When an inch-long murder hornet buzzed back to its nest in a remote Washington state forest not long ago, the seed to its destruction dangled from a piece of dental floss – a small transceiver that allowed entomologists to tap the power of geographic information systems (GIS) to track down and destroy a massive colony.

The Asian Giant Hornet (aka, murder hornet) is the world's largest species of hornet. While the hornets generally don't attack people, they do destroy honeybees that pollinate U.S. crops – a multi-billion-dollar industry and vital part of our food supply chain. If the Asian Giant Hornet becomes established, it will pose a risk to our environment, economy, and public health.

Starting back in 2019, the Washington State Department of Agriculture (WSDA) received and verified two reports of Asian giant hornet near Blaine, Washington in 2019. These are the first-ever sightings in the United States.

After receiving additional reports in 2020, the WSDA conducted the first-ever eradication of an Asian Giant Hornet nest in the United States. The effort involved an innovative use of technology that showcased the power of GIS by enlisting hundreds of citizen scientists who placed and monitored live hornet traps for months at a time and registered their traps using a WSDA web-based mapping application developed for the effort.

This information was automatically updated on a GIS system allowing the state to narrow down where the hornets live using GIS and ultimately following a live hornet by tying a small transmitter to it with dental floss until the nest was located.

The use of GIS is key to Washington state's battle to seek and destroy murder hornet nests before they can spread throughout the United States and a prime example of the transformation that GIS has undergone since the start of the COVID-19 pandemic.



implemented both internal and external web-based dashboards that allowed for seamless reporting and tracking of hornet detections, showed total trap counts as well as maps of the trap locations, and hornet detections.



When WSDA was able to effectively build and trap live hornets, mobile apps were used to create and show tracklines of areas surveyed by field crews as well as mark areas of potential nests for more in-depth survey later in the day as they tracked hornets using radio frequency transmitters. The use of these tools allowed WSDA to analyze this wealth of geospatial data showing clustering of hornet detections, locate gaps in surveyed areas using satellite imagery, and spot patterns in potential hornet movements.

This ultimately led to the final live hornet release point for tracking that ended up less than 800 feet from the first-ever Asian giant hornet nest in the U.S. being detected and eradicated by WSDA. The success of the survey program was an incredible team effort led by dedicated and relentless entomologists, field surveyors, program managers, administrative staff, and public outreach specialists all of whom became experts in effectively implementing and utilizing every element of the GIS toolset at their disposal.

Real-time intelligence to fight wildfires

This past summer GIS was used to track more than a thousand wildfires burning over 713,000 acres statewide.

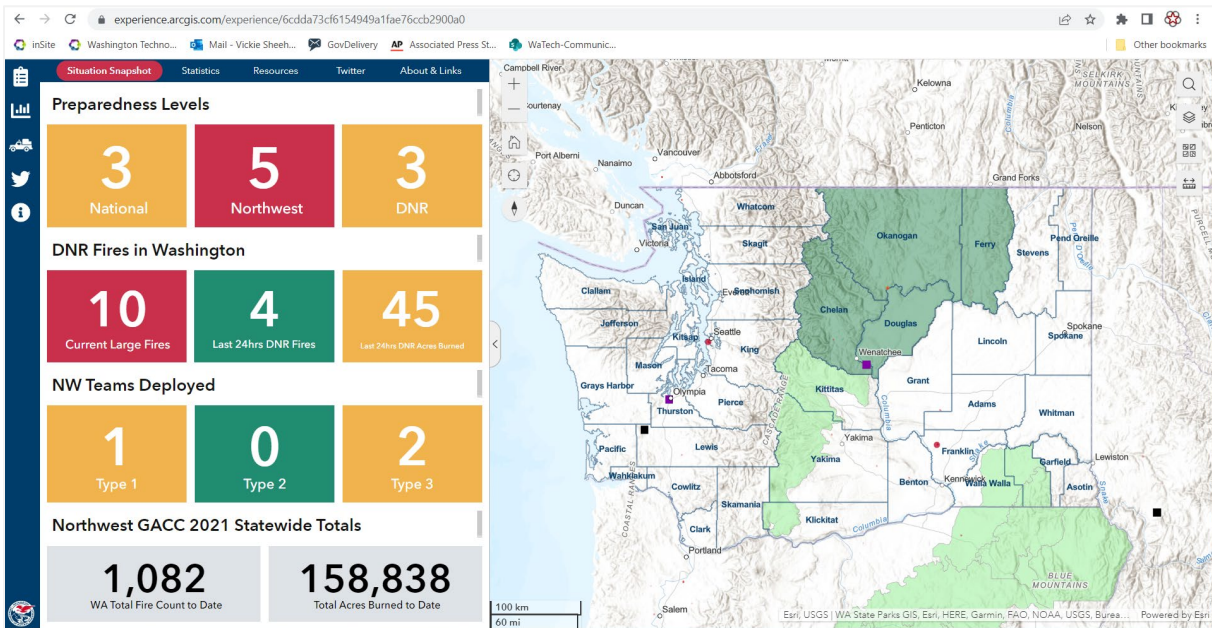
The fire season represented a worst-case scenario with weather, fuel, and topography. Department of Natural Resources (DNR) developed a publicly available, mobile-friendly map-driven [web application](#) providing users with a single source of current wildfire information compiled from all six DNR and interagency dispatch offices. Tapping into data feeds from the other interagency partners this solution provided situational awareness and focused on real-time intelligence from all available sources through the wildfire dashboard.

Features included:

- A streamlined, interactive web map that displays several important GIS layers for wildfire managers.
- A Situation Snapshot panel providing users an in-depth look at the current wildfire situation.
- A Resource Status panel capturing the status of assigned/available ground and aviation resources throughout the state.
- Year-to-Date Fire Statistics depicting statistical summaries aimed at providing a single, around-the-clock source for the total number of responses, fires, and acres burned in total and by month.
- DNR Fire Twitter compilations using a live Twitter feed from WA State DNR Wildfire, allowing users to keep their “finger on the pulse” of wildfire in the state.

In addition, aviation experts (helicopters and fix winged aircraft) relied heavily on GIS for aerial support in 2020. This included coordinating limited resources, used for daily briefings, determining how to shift things around each day and using hotspot analysis from 10 years of Fourth of July holidays to help state fire fighters prioritize where to put resources to be more effective.

The information is publicly available and used by local fire managers and reporters. This supported consistent communications reporting with real time updates on lightning strikes.



What's next

The Washington State Geospatial Program Office the Washington State Geospatial Program Office is developing a legislatively mandated common data-sharing platform for public organizations in Washington to host and share sensitive natural hazards mitigation geospatial data. There is no common platform for state, local and higher-education organizations to share existing state geospatial data on natural hazards risks.

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The project steering committee and customer advisory group consists of the Department of Ecology, Department of Natural Resources, Sea Grant Washington, Climate Impacts Group, Office of the Insurance Commissioner, State Department of Health, State Water Research Center.

