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WEB-BASED MAPPING APPLICATIONS IN RESONSE TO WILDLAND FIRES

Elizabeth Lile
US Geological Survey
Denver, CO

Cliff Inbau
ESRI
Broomfield, CO

1. ABSTRACT

Wildland fire coordination centers have the difficult task of determining where to position critical wildland firefighting resources. This task is compounded when several large fires occur simultaneously across vast geographic areas. According to the National Interagency Fire Center (NIFC) in Boise, Idaho, over 6.9 million acres burned during the 2002 fire season across the U.S. The best information available to the Multi-Agency Geographic Area Coordination Committees for prioritizing requests for firefighting resources has been the National Situation Report, a daily textual report of large fires updated by NIFC. The use of web-based mapping applications, such as GeoMAC in particular, have shown great success as wildland fire management tools for evaluating and assessing risk and planning resource needs. An unexpected positive result of GeoMAC is the interest shown by the general public about the web site. The GeoMAC website experienced over 1.7 million requests during one day in June 2002.

The USGS developed GeoMAC, and other related web tools, to automatically retrieve spatial and tabular data from a variety of sources on a daily basis. Then, post this information to the web site. GeoMAC uses ArcIMS, ArcSDE and is supported by a redundant, high availability system. By integrating various data sets into a single source and making the information available via the Internet, wildfire managers and the public are able to obtain more information than ever before about the potential risks posed by wildland fires to lives and property.

2. BACKGROUND

GeoMAC (Geospatial Multi-Agency Coordination) is an interactive web-mapping tool that displays information about wildland fires. The National Interagency Fire Center (NIFC) in Boise, Idaho sponsors the site. The US Geological Survey (USGS) is the primary developer and has hosted the site since 2000. The GeoMAC Team includes U.S. Forest Service, Bureau of Land Management, National Park Service, Fish & Wildlife Service, Bureau of Indian Affairs, National Oceanic and Atmospheric Administration, National Weather Service and USGS.

Wildland fire coordination centers have the difficult task of determining where to position critical wildland firefighting resources. This task is compounded with the increasing number of large fires occurring simultaneously across vast geographic areas. According to the National Interagency Fire Center (NIFC) in Boise, Idaho, at one point in time during the FY2000 wildland fire season, more than one million acres were burning in 84 fires across Arizona, California, Idaho, Montana, Nevada, Oklahoma, Texas, Utah, and Wyoming. The best information available to the Multi-Agency Geographic Area Coordination Committees (GACCs) for prioritizing requests for firefighting resources has been the National Situation Report or Sit Report, a daily textual report of large fires created by NIFC.

To provide the Geographic Area Coordination Centers (GACC) with additional geospatial information, an interagency team of wildland fire and Geographic Information Systems (GIS) specialists, the Geospatial Multi-Agency Committee (GeoMAC), was assembled in August 2000 under the Incident Command System. The group was tasked with the implementation of a World Wide Web-based map application combining current wildland fire intelligence information with geospatial data, to streamline information processing. Fire managers would be able to visually evaluate the wildland fire situation across a broad geographic area. GeoMAC provided fire coordination center managers, dispatchers, fire-intelligence officers, fire-behavior analysts, local and national Incident Management Teams with data and tools tailored to their needs. The initial development was done as a real-time response to wildland fire managers' requirements that were being defined as the application was built. In a period of less than two weeks, the GeoMAC project progressed from conception to full implementation.

Elizabeth Lile, USGS, Rocky Mountain Mapping Center, Denver, CO 80225;
e-mail: ellile@usgs.gov

Figure 1: GeoMACs initial page.

3. GeoMAC APPLICATION

Since 2000 GeoMAC has migrated to a public information site. It is built on the success of the GeoMAC development as a wildland fire management tool for evaluating and assessing resources at risk. The original scope of the project was to provide information at the strategic overview level. The value of displaying seamless integrated data layers in conjunction with fire specific data over the web as a public information tool soon became apparent. Accessing the Wildfire Mapping section of the application, users are able to view fire perimeters in relation to base layer information such as roads, and communities. They are also able to view the fires in relation to other fires, satellite data, and Remote Access Weather Station (RAWS) data.

Some common misconceptions about GeoMAC are that:
1) GeoMAC can tell you if your house has burned. This is false because the site uses small-scale data; there is not enough detail to determine whether a fire has affected individual structures.
2) GeoMAC is used by incident commanders to fight fires. Again this is false, it is used to provide a strategic overview of where large fires are located.
3) GeoMAC is a USGS project. GeoMAC is a NIFC project; it is housed at the Rocky Mountain Mapping Center in Denver, CO.
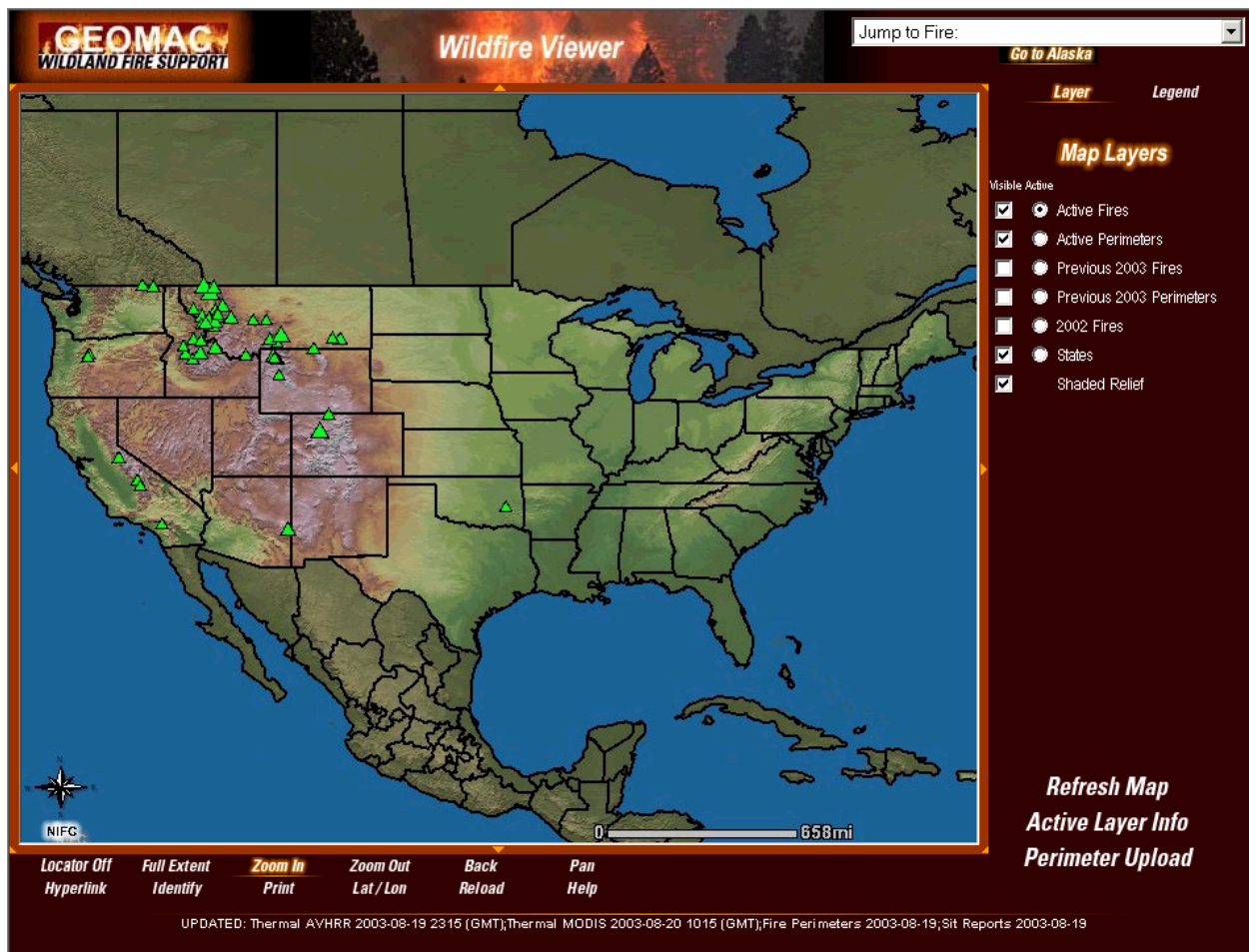
Figure 2: GeoMAC overview

Once in the application, the large fires are displayed across the landscape (figure 2). This data is from the NIFC database in Kansas City. This screen provides a wealth of information showing fires in relation to other fires across the continental US and how they are dispersed. The size of the triangle is relational to the size of the fire. The public never before had access to this type of visual interpretation of a wildland fire season. The information about the location of fires was in textual reports; fire managers kept track of fire locations with stickpins or magnets on maps on office walls. A regional manager would have an idea of the fire situation in his region but perhaps not in the adjoining region.

GeoMAC has a set of tools used to navigate the information available on the site. Using the 'Zoom In' tool and dragging a box on the screen changes the scale of the view. The 'Jump to Fire' tool allows users to choose the fire of interest from a drop-down list and center the chosen fire within the display screen. Other tools for navigating the site include 'Zoom Out' and 'Pan'. The site also allows access to textual information (attributes)

about features. Using the identify or hyperlink tools will display the text information.

The power of a web-mapping application lies in the data integration and display. The GeoMAC data is stored in ArcSDE locally at RMMC. More layers of information are available as you 'Zoom' into a location. Zooming into larger scale, immediately more information is available. These layers can now be made visible in any combination the user wants. In Figure 3, the fire perimeter, Remote Access Weather stations (RAWS), road shields and cities have been made visible. The Active layer is the situation fire. Only one layer can be active at a time, the only layer upon which the 'Identify' tool can be used. The view shows the RAWS stations with the names of the stations are immediately available. Instead of having to access another website to find out the weather information the user can use the hyperlink tool and directly access the weather data. The weather data is updated every hour and, now because of the integration of the data and links to databases, the user has direct access to critical weather information. The Sit Report data works the same way, with a direct link to NIFC's
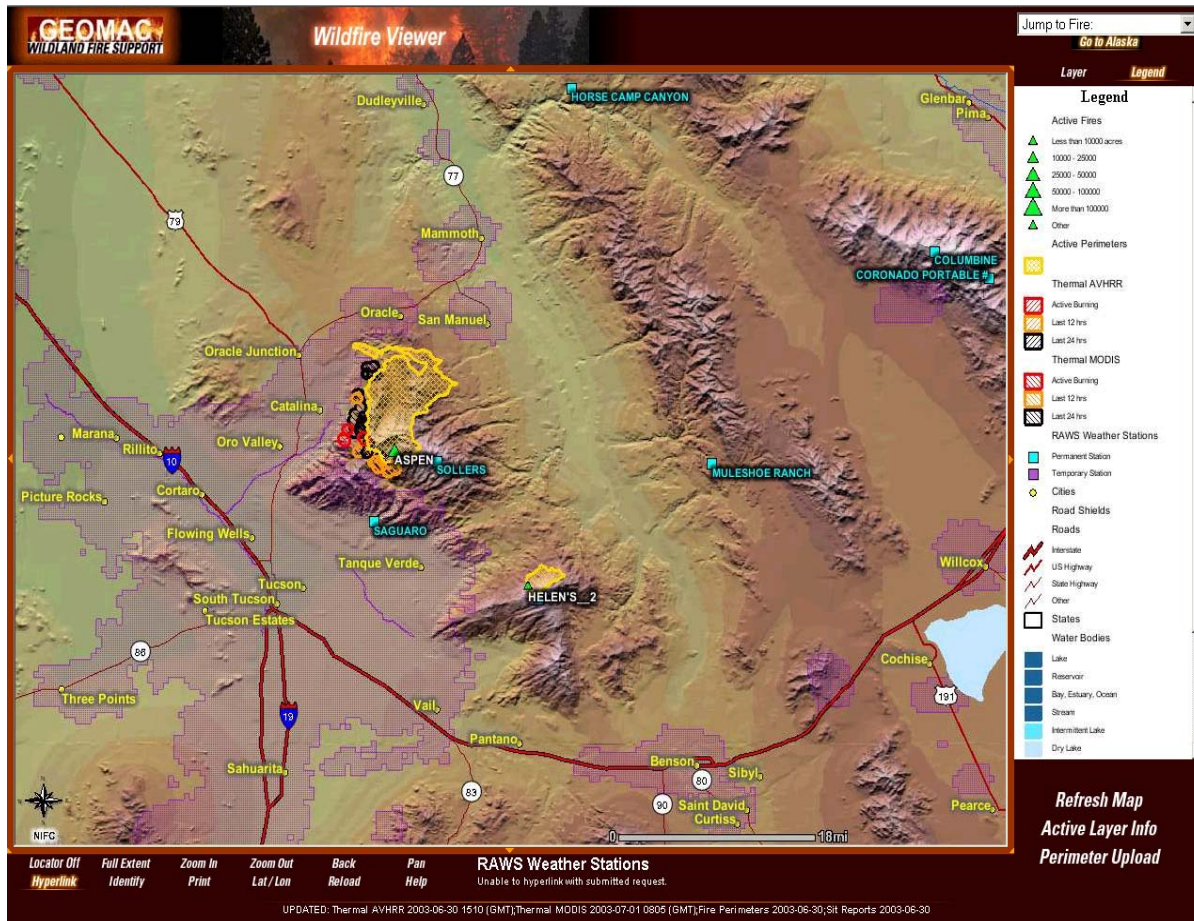
Figure 3: GeoMAC with additional layers visible

One of the outstanding components of the GeoMAC site is its display of dynamic data layers. The Thermal Advanced Very High Resolution Radiometer (AVHRR) and the Moderate Resolution Imaging Spectroradiometer (MODIS) are thermal images used to depict fire locations. The data is symbolized with red being the most recent to orange to yellow. Due to download schedules and processing times the 'most recent' data is usually 12 hours old. This data is used to predict fire movement. The AVHRR and MODIS data are uploaded daily using batch processes. The batch processes retrieve and load information from remote sites as new information becomes available. The Urban Interface layer is derived from the Defense Meteorological Satellite Program (DMSP), which detects faint sources of visible-near infrared emissions including cities and towns.

A perimeter upload form is available on the site for field personnel to upload fire perimeters. This form is a mechanism to standardize and streamline accessing the data. The fire perimeter layer is still processed manually, due to standardization issues. An additional benefit of having the fire perimeters displayed on the site is that the site is now a central location for fire perimeters. After fire season there are numerous requests for the fire perimeter data from the media, scientists, and students for their projects. Another layer in the application is the inactive fire layer. This is a record of all the fires that burned during a season; the inactive fires are color coded as to cause with black indicating lightening and red indicating human causes. This is another data layer in high demand at the end of a fire season.

4. CONCLUSION

The use of web-based mapping applications for integrating various data layers and providing information has shown great success. The public has shown a tremendous interest in GeoMAC as a source of wildland fire information. The GeoMAC website experienced over 50 million requests during the 2002 fire season. By integrating various data sets into a single source and making the information available via the world-wide web people are able to obtain more information than ever before about the potential risks posed by wildland fires to lives and property.
URL: www.geomac.gov