Title of Paper

Using ArcGIS to Create an Emergency Response Fire Atlas - 1580

Authors' Names

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Abstract

Access to facilities and water sources is critical in emergency response to wildlands fire. This paper describes the process East Bay Municipal Utility District uses to collect field data and visually display emergency response information using ArcPad and ArcGIS tools. Utilizing ArcMap software's new ArcPad toolbar, data is checked out from the geodatabase to ArcPad so rangers can collect data while working in the field. After the new data is checked back into the geodatabase, ArcMap software's Map Book tool is used to create an atlas displaying critical information for fire responders around the District's property. This atlas is passed out to all agencies that respond to wildland fires in jurisdictions surrounding the District's watershed property. This area is known as the Mokelumne Area by EBMUD staff.

Introduction

The East Bay Municipal Utility District (EBMUD) is located in the San Francisco Bay Area in Northern California and delivers water to 23 cities and communities with over 1.3 million customers in Alameda and Contra Costa Counties. Water is supplied from the 577-square-mile Mokelumne River watershed located approximately 100 miles east of the EBMUD service area in the Sierra Nevada Mountain Range. Raw drinking water is stored in Pardee Reservoir at the base of the watershed, and is conveyed through the Mokelumne Aqueduct to the EBMUD service area. EBMUD owns and manages almost 55,000 acres of land in Alameda, Amador, Calaveras, Contra Costa, and San Joaquin counties.   Of this acreage, approximately 26,000 acres is located surrounding

Camanche and Pardee Reservoirs in the Sierra Nevada (Figure 1).

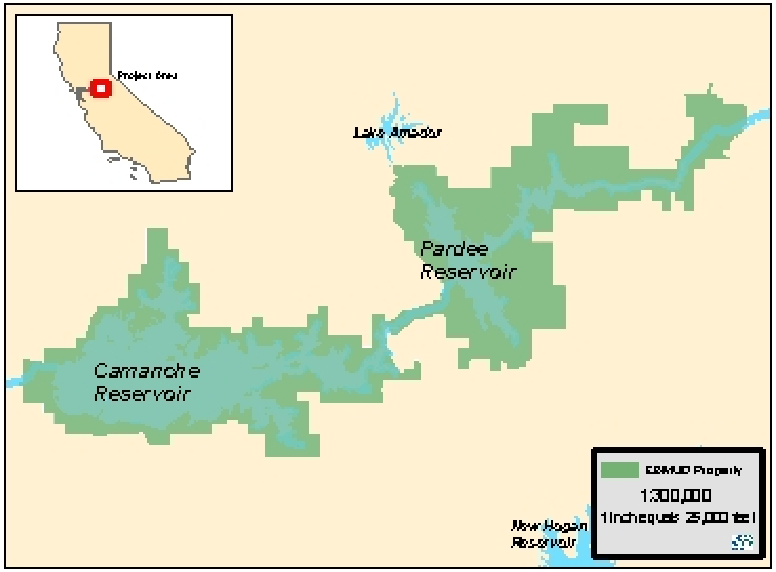

Figure 1: East Bay Municipal Utility District Property

Objectives

EBMUD has a well-developed GIS program including a variety of applications used throughout different work groups in the District. Unfortunately, the Mokelumne Area offices (those surrounding the Pardee and Camanche Reservoirs) have been overlooked during much of the District's GIS development in the last decade. This neglect is primarily due to the remoteness of the facility and the associated inability of GIS staff to work directly with Mokelumne Area Rangers. In the spring of 2003, the GIS group received a request to develop a fire atlas covering the Mokelumne region. The purpose of the atlas is to provide critical information to first responders in the fire districts surrounding EBMUD's property. A secondary benefit of the project is the development of GIS data and applications for the Mokelumne Area. Building a fire atlas requires the collection of multiple GIS data layers and significant work using GIS software. Therefore, we saw this as an opportunity to build the Mokelumne office's GIS infrastructure while also training their staff to be self-sufficient for future projects.

Methods

We began the project during the summer of 2003, envisioning a combination of data collection techniques. Most of the data layers could partially be identified using our three-foot pixel aerial photography, but many features would require field investigation. At the time, EBMUD was still hesitant about fully implementing ArcGIS software. Most of our users still worked on ArcView 3.2 or Workstation ArcInfo. Because only a couple of the staff in the Mokelumne office had GIS experience, we decided to risk using ArcGIS instead of training them on an earlier version of the software. Additionally, we obtained approval to purchase two Compaq iPAQ Pocket PC's loaded with ArcPad 6.0.2. The District already owned several GPS units and for this project we started using a Trimble DGPS

Initial meetings between the GIS staff and ranger supervisors resulted in a list of proposed GIS data layers and their associated attributes (Table 1). As a result of these meetings, a personal geodatabase was built in ArcGIS 8.3 and existing shapefiles and coverages were converted into this geodatabase. New feature classes were built and domains were added when applicable to make data collection as simple and error free as possible.

Table 1: GIS Data Layers

For our initial data collection phase we set up an ArcMap project showing an overview of the entire Mokelumne area. We planned to use ArcMap's ArcPad extension in combination with Microsoft's ActiveSync system to check out data for collection. We hoped this automated system would allow Rangers with minimal experience to check out feature classes without getting confused by the location and architecture of the geodatabase. We ran into some difficulty using the ActiveSync tool because of the program's insistence that files be checked out to the user's My Documents folder. Since 12 staff members were initially involved in the data collection, we found it easier to simply checkout the data through ArcMap's ArcPad toolbar then manually copy the clipped layers to the handheld device.

Figure 2: Staff collects hydrant location using ArcPad

We then proceeded to visit the Mokelumne office three to four times per month while the data collection was in progress (Figure 2). During most visits, we collected data in the field and also identified features via the aerial photos in ArcMap. After approximately 10-12 data collection sessions, there was enough information to begin putting together the atlas. Using ArcMap 8.3's MapBook extension, we built a grid to cover our property and adjacent “threat zones.” We found that it was impossible to fit everything into a one size fits all grid. Even though the study area was rural, there were a small number of regions with relatively built-up infrastructure. Our original grid was created in equal 1:24,000 sized cells (Figure 3). This size worked well for undeveloped regions, but for campgrounds and areas near our dams, we decided to sub-divide the 1:24,000 grid into smaller insets (Figure 4). This allowed us to show more detail of specific regions without creating an overwhelmingly large atlas. Additional overview pages were added to the front of the atlas to give a bigger picture to the reader.

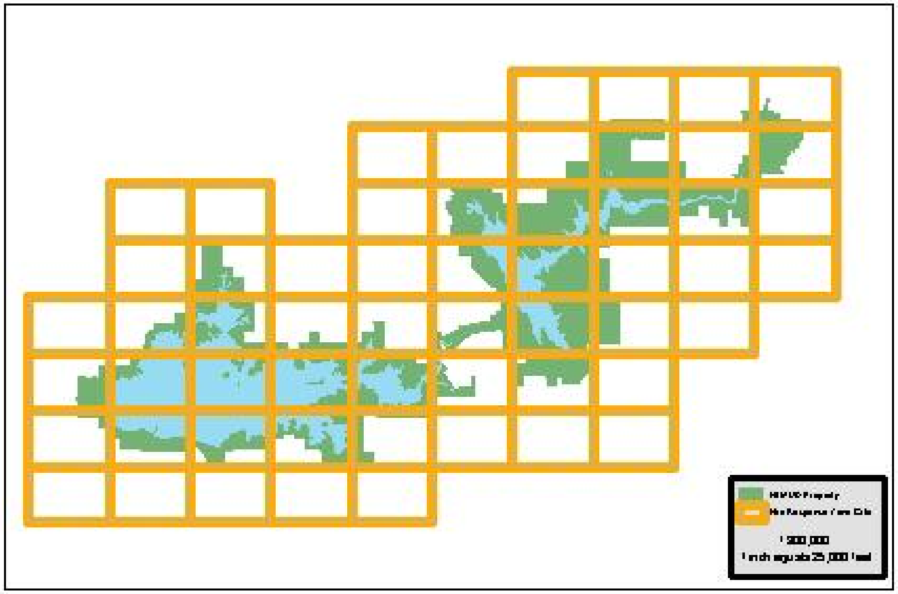

Figure 3: MapBook 1:24,000 fire atlas grid for entire property area

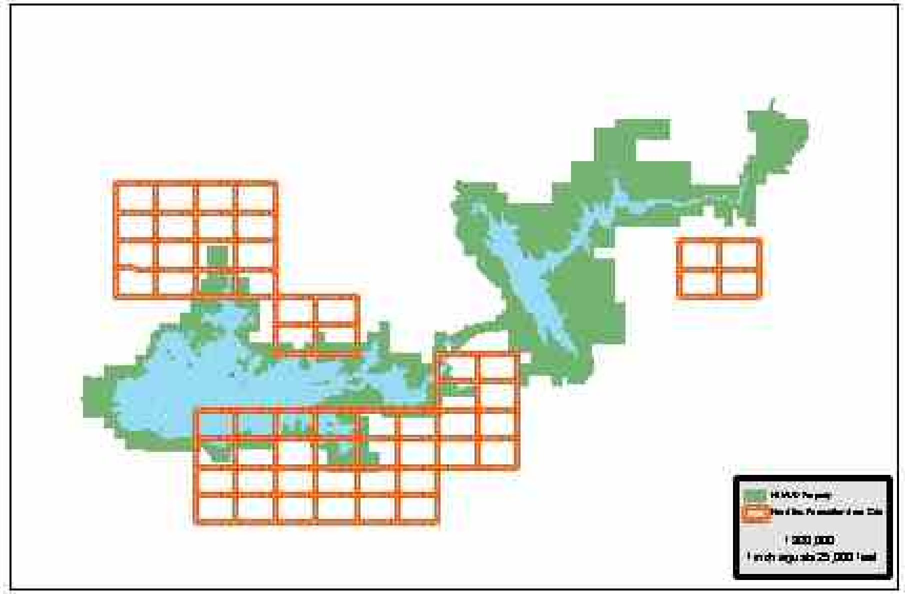

Figure 4: MapBook 1:12,000 fire atlas grid for developed areas

Results

The atlas is still in draft phase. Approximately twenty copies are going out to EBMUD staff to evaluate during the current fire season. At the end of the season, comments on the atlas will be collected and further evaluated. A final draft is expected to be passed out to surrounding fire districts in 2005.

The data collection portion of the project was carried out by three separate ranger work groups within the same division. At the outset, we envisioned training all 12 rangers in the division to collect data. Since the GIS group operates out of the Oakland office 100 miles west of the study site, we could only visit the site 3-4 times per month. In between visits, we hoped rangers would take the initiative and use the ArcPad\GPS tools to collect data on their own. Due to other work priorities and a lack of training, most of the rangers were not able to operate the equipment in between the GIS group visits. Since we only took out two rangers per visit, a couple of months went by between some of the rangers' training sessions. We found ourselves starting over every time we went out in the field, so we modified our training goals and identified one individual from each work group to train on the data collection procedures. We found that fewer users with a larger amount of training time was a more effective approach towards building self-sufficiency.

We also found the GPS unit and Pocket PC to be cumbersome. Most of the data collection involved driving to a location with minimal hiking. Getting in and out of a truck with two pieces of equipment and several cords proved awkward. Towards the end of the data collection period, we purchased a Trimble GeoXM with ArcPad, which is proving to be a more rugged and less cumbersome tool for the field crews.

Finally, we found that like any project, clearly identifying objectives and deadlines is critical to completing a project. One of the shortcomings of our current draft is missing and erroneous annotation. A small, but significant number of the rural county roads in our street data layer do not have a name or are incorrectly labeled. For our final product, we hope to go through each street and geographic named place and build a complete annotation layer that can be used on future projects. We could have gone on collecting data and editing annotation for several months, but we met our originally stated goals and decided to cease work at that point to get a product out for the current fire season. Putting a draft into the hands of our Rangers in time for fire season will hopefully prove far more beneficial than would another few months of discussing edits in front of the computer.

Acknowledgments

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References

All figures were created by East Bay Municipal Utility District.

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