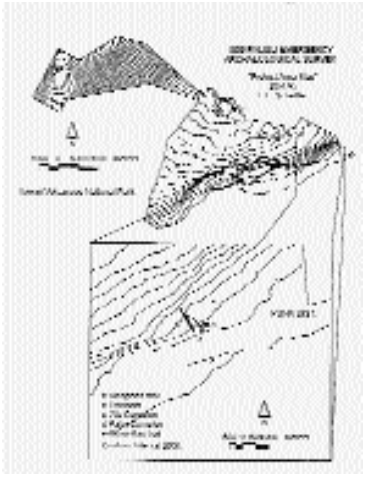
Jamie M. Donahoe

Emergency Resource Recordation

GPS May Be Your Best Bet



Hawaii Volcanoes National Park; 1995 Paliuli Emergency Archeological Survey. Project Area Map by T.E. Scheffler.

The National Park Service has been using GPS (Global Positioning System) in resource mapping applications for several years. The List of Classified Structures (LCS) teams, working since 1992, have generated locational data for most of the structures included on that list. Natural resource programs have used GPS for a number of purposes, including monitoring research plots. Recently, however, the Pacific West Field Area has found that GPS can be a significant tool for emergency resource recordation.

GPS is a method of generating fast, accurate locational data by using radio signals from satellites to triangulate a position anywhere on earth. Very simply, a GPS receiver calculates a 3D position using the time it takes for radio signals to travel from four or more satellites orbiting the earth to the receiver. The full constellation of 24 satellites is now in operation, giving full-time, world-wide coverage. Depending on the GPS equipment, it is possible to get sub-meter accuracy within a second. Some models of GPS receivers, such as Trimble's Pathfinder Pro XL used in many parks, have a data dictionary feature which enables collection of attribute information as well as the location of a given resource. GPS is particularly well suited for work in areas where there are no standard positioning aids such as benchmarks or permanent natural landmarks, as in the two examples described here.

GPS was used to expedite data collection necessitated by the Vision Fire at Point Reyes National Seashore in California, and by impending lava flows in Hawaii Volcanoes National Park. In the case of Hawaii Volcanoes, information was going to be irretrievably lost as archeological sites by the hundreds are inundated by lava flows from the Pu'u 'O'o eruption which began in January 1983. At Point Reyes, information needed to be collected so damage assessments could be made and lists of affected resources compiled.

The October 1995 Vision Fire at Point Reyes National Seashore began when an illegal campfire flared up under the high wind and low humidity—perfect firestorm conditions. The fire, which ultimately burned more than 12,350 acres, also destroyed 47 homes and structures. Two park structures were lost.

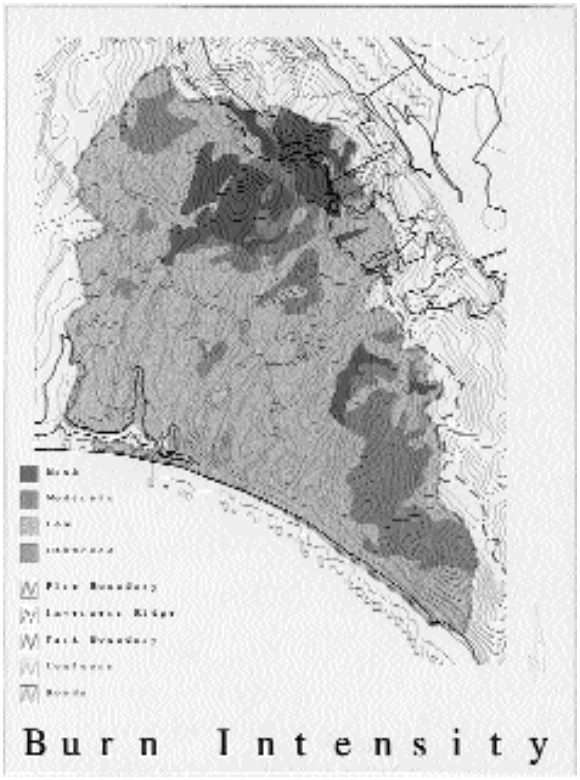
In fighting a fire, information about the terrain and particular resources that need to be protected is critical to determining a strategy for fighting the fire. The steep canyons of Point Reyes were often inaccessible to fire trucks. Firefighters needed to know which structures needed to be protected and where they could and couldn't get with their equipment. In addition, the resource management staff needed to know what park resources had been affected, both for planning purposes and for release of information to the media.

Two GIS (Geographic Information System) mapping efforts were fully functioning within 24 hours of the initial response. California's Office of Emergency Services (OES) used GPS data to map the fire perimeter and the destroyed, damaged and threatened structures. The fire perimeter was flown each day and the data captured using a hand-held GPS receiver. While only accurate to 100 meters since the data was not post-processed, it was accurate enough for delineating a 12,000-acre area. Once the perimeter was defined, statistics such as acreage burned were easily calculated. The park's GIS and other resource management staff concentrated on plotting threatened and endangered (T&E) species habitat and generating vegetation maps and other resource locator maps for use by the DOI's inter-agency Burned Area Emergency Rehabilitation (BAER) team, which was responsible for submitting a report on rehabilitation needs and plans within three days of the fire's control. Twenty-three miles of dozer lines, put in as fire breaks while trying to control the fire, were walked and mapped, and data such as width and slope were recorded to help calculate rehabilitation efforts and costs.

Without the extensive computer mapping and GPS capabilities available to the teams, the task would have been even more difficult to

accomplish. Trimble Navigation, located in nearby Sunnyvale, loaned the park five of its GPS units, four of which were capable of real time data correction, further expediting data collection. Park staff from several divisions were quickly trained on the equipment and sent out into the field beginning the Friday after the fire began.

Data collection continued after the fire was contained in order to assess the damage to the park's resources. Burn severity was measured at known threatened and endangered plant sites. The area was also systematically surveyed for disturbed cultural resources. The BAER team looked at archeological sites and historic dairy ranch sites, examining trees, fence lines, and looking for newly exposed trash dumps. They focused primarily on previously identified archeological sites, but also did a cursory survey for new sites. Known archeological sites were re-recorded, including 13 Coast Miwok Indian sites, two military sites, and nine 19th–century ranch sites. A number of trash dumps were revealed, and their locations were recorded with GPS before being reburied for protection. These data files were corrected by post-processing, yielding close to seven-meter accuracy.



Damage to other park resources, such as trails, bridges, and signs, was also recorded using GPS. Roads and trails crews will thoroughly map the trail system in the spring, when all trails will be walked.

In the weeks after the fire, active natural resource data collection continued. Park staff established new research plots in order to monitor burn recovery, collected site data with the GPS receiver, and incorporated it into the park's GIS. They developed a data dictionary based on site attributes and recorded the location and site attribute information. Ten plots were established to track four T&E plant species. These are new plots, where no rigorous scientific data had been yet collected. After the first rains they will be checked and then monitored on a periodic basis to study the various plants' recovery. GPS will be used to relocate the plots since the landscape will change quickly as vegetation reappears.

At Hawaii Volcanoes National Park, an estimated 15,000 archeological sites and features have been lost to lava flows in the last 12 years. In 1993, the flows began moving toward a large section of known archeological features. Faced with losing additional sites, the park applied for emergency funding so that they could record the location of sites before they were inundated.

NPS Research Assistant Timothy Scheffler had been working on a mapping project at Kaloko-Honokohau, but when funding became available, he spent two months at Hawaii Volcanoes mapping archeological features at Lae'apuki / Panau Iki Ahupua'a in the Mo'olehua area of the park, the section facing the greatest threat of being inundated by the lava. Cathy Glidden was the principal investigator for the project; reports are forthcoming. Briefly, the goal of the project was to use the location data to study the distribution of the features. In addition, using the data dictionary feature, they were able to collect information about each feature's length, height, width, and condition; about the soil and vegetation presence; and develop an overall geographical context for all the points, all in a fraction of the amount of time it would have taken to record the information by hand. The geographic context allows for density and distribution analyses. The data files were exported to AutoCAD files so maps could be generated. In addition, the project team used GPS to record the location of two large petroglyph fields. The park now has an ongoing GPS-based recordation project, for which the emergency work provided the basis.

GPS enabled the park to quickly gather significant data about several hundred archeological features before they were buried by the advancing lava flow. The park staff likes to say they have "permanently stabilized" those features by encasing them in lava.

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