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Risk analysis and mapping for wildfire management in the Aegean Islands of Greece

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Abstract

Over the years, civil protection agencies have been calling for a deeper integration of information technology and wildfire management that can assist managers in making informed decisions at every stage of wildfire response and mitigation. We present a system called fireAEGIS (in the framework of the project AEGIS+) that was designed as a decision support system for the islands of the Aegean Archipelago in Greece. fireAEGIS combines real-time data integration, predictive modeling, risk assessment, decision optimization, mobile accessibility, historical data analysis, training resources, system integration and continuous improvement to empower wildfire management teams with the necessary tools and information for effective decision-making and response to wildfires. System architecture is founded on a WebGIS interface, accessible through both mobile devices and web browsers. fireAEGIS can gather and integrate real-time data from various sources, including weather stations, live cameras and ground sensors, providing unimpeded and free access to the recorded data archive. The historical data analysis module stores and analyzes historical wildfire, enabling decision-makers to identify trends, patterns and lessons learned from past events. Wildfire history has been produced from analyzing all the available satellite images from the Google Earth Engine since 1980, using algorithms that map fire severity and enable perimeter delineation. This knowledge can inform decision-making processes, such as resource allocation, prevention strategies and post-fire recovery efforts, through the ArcGIS Operational Dashboard interface. The system can also employ advanced predictive modeling techniques and simulation tools to forecast the behavior and spread of wildfires, utilizing the Minimum Travel Time Algorithm under different weather conditions over a web interface that requires minimum inputs from the end-users. Inputs include fire duration, ignition point, fuel moisture scenario, preferred weather station to retrieve the latest recorded wind speed and direction, or manually provide them. Users can also access and retrieve the spatial outputs from their past simulations. Finally, the WebGIS component provides risk analysis and mapping capabilities that help prioritize resources and actions for effective fire response and evacuation planning. Users can assess datasets or create

web maps of the potential risks posed by wildfires to different areas, including residential zones, infrastructure, natural resources and wildlife habitats. All modules that comprise fireAEGIS were requested by the engaged stakeholders of the region, and their integration and interplay allow for seamless data access, enhanced situational awareness and streamlined coordination among different agencies. The system is accessible at http://aegisplusrisk.aegean.gr/.

Keywords: fire behavior modelling, decision support system, weather monitoring, AEGIS+, WebGIS

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