

Early Detection Methods for Wildfires Using Satellite Remote Sensing

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Fires were once natural phenomena that in many ways served as a balance and contributed to the natural evolution of ecosystems. However, in many regions of the world today, human interference has altered the natural course that fires once took. In Europe, only 5% of forest fires are of natural cause, with majority of forest fires resulting from human activity. Human-caused fires cause irreversible damage to natural entities and human assets. Additionally, greenhouse gases are produced during the forest fire process, and depletes once stable forests of their carbon sinks. It is apparent that populated regions or areas of high environmental value are greatly threatened by forest fire activity. Another type of fire that affects public health is the wildland fire. Wildfires are a complex combustion source with several categories of fuels. It is defined by fire behavior that changes over time with the fuel content and weather variations. The smoke from wildfires is composed of hundreds of chemicals in gaseous, liquid, and solid forms that affect visibility. Some of the main concerns for land owners are the production of particulate matter from wildfires. Remote sensing is an adequate method for assisting authorities in making decisions regarding fire-fighting. Satellite remote sensing and Geographic Information Systems (GISs) provide distinct monitoring capabilities for different fire characteristics: areas that are dry and susceptible to wildfire outbreak, actively flaming and smoldering fires, burned areas, smoke and gas emissions.

Satellite remote sensing is an efficient and economical means for serving the role as the first step in detecting, containing and extinguishing a fire. Remote sensing can operate by monitoring fires and smoke plume over large areas on a routinely basis. Satellite observations provide timely information on fire development and smoke plume trajectory. Several satellite systems are currently available for fire monitoring with different capacities in terms of spatial resolution, sensitivity, spectral bands, times, and frequencies of overpasses. This is very important since fires vary widely in size, duration and temperature. In the tropics, where it is moist and humid, fires have a strong diurnal cycle, making remote sensing a sufficient practice for indicating wildfire activity and decreasing peak intensities. Large areas affected by the fire, the dynamic nature of the process, and the low accessibility of many key fire regions, make satellite remote sensing a valuable and very necessary research/monitoring tool.

The student will make use of both satellite remote sensing and GIS software to study and track recent (over the last decade) wildfires in the United States and, if possible, quantify the damages (on public health and otherwise) associated with them. The satellites (and their respective instruments) that the student might use to monitor these wildfires include, but are not limited to: NOAA GOES (Imager), NOAA POES (AVHRR), Aqua (MODIS), and Terra (MODIS).

Keywords: public health, Geographic Information Systems (GISs), remote sensing

Data Source: NOAA GOES (Imager), NOAA POES (AVHRR), Aqua (MODIS), and Terra (MODIS).