Interactive Forest Fires Maps with Statistics for Local Managements in Northern Thailand

Wacharapong Srisang

Abstract—Forest fires are a serious problem in Thailand. Every year, it emits the serious amount of the smoke and particulate matters as least as 10 micrometers in size (PM10), which severely causes health problems, to the atmosphere. This study aims to introduce a new type of forest fire map, which is developed from the remaining one, to help identify levels of fire danger in a sub district scale, the smallest administration scale in Thailand. In this study, two types of data, forest fire data products by NASA and administration data of Thailand, are employed. The map is created with Google Earth API technology. The system may help the government to plan or to manage budgets for solving fire problem in the northern Thailand more effectively.

Keywords—Forest fire map, active fire data products, Google API

I. INTRODUCTION

FOREST fires are serious problem in Thailand. Every year, the severe amount of smog with PM10, which causes suffer from health problems, is emitted to the atmosphere [1]. Forest fires can be observed by satellites. Scientists use the satellite data of optical and thermal properties of the earth's surface to develop algorithms, which are capable of detecting forest fires occurring on the ground around the world. [2, 3]. Aqua and Terra MODIS are the satellites which Fire Information for Resource Management System (FIRMS) uses to produce active fire data products, which are used in plenty of forest fire studies as well as this study [4-6]. Similarly, the data from Aqua and Terra MODIS is also the database of the map service for public uses on website of Geo-Informatics and Space Technology Development Agency (Public Organization, GISTDA) in Thailand [7]. However, while the active fire data products are featured in convenient assessment to download and easy to use, they still need enhancement by combining it with other kinds of data.

This research aims to compact the global scale of data to the more comprehensible local one. New visualization is created to show the data on the map using Google Earth API technology, which is more user-friendly for non-experts. The map in this study is the first which shows fire statistics in a sub-district scale.

II. MATERIAL AND METHOD

A. Data

In this study, two sets of data, the forest fire data and Thailand’s administrative data, were combined to create a new map of forest fires.

The active fire data was free data retrieved from Fire Information for Resource Management System (FIRMS) [3]. The original data helped indicate fire hotspot properties and locations in certain latitude and longitude.

The Local Administrative data was retrieved from the Ministry of Transport, The Royal Thai Government [8]. This data illustrated the location with governmental administrative region, like sub-district, district, and province.

B. Computing

The program is created to indicate forest fire hotspots in each sub district to determine the regions which are at risk of the fires. In this term, points in Polygon computations were performed. This new computed data contained three more attributes than those in the data of FIRMS, which contained 13 ones. The exceeding were sub-district name, district name and province name. This step consumed plenty of time and computational resources because each sub district was in a very complicated shape to generalize. Next, more attributes were added into each statistical analysis of the data. Then, the

Fig. 1 The 2005 map of Chiang Rai. The redish tones indicate the degrees of severity of the problem.
number of fires in each sub district was counted to create the map and its illustrating graphs.

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**C. Visualization**

The new approached data was employed to visualize spatial and temporal factors of fire activities. The number of fires which occurred in each sub district was counted every month as collected data for the map. Red color was assigned to the area in which fires occurred frequently, and green is for the safe regions from the fires. The data map was developed from Google KML form as Google Earth program was not so widely used. Importantly, Google map API was more user-friendly. In this case, bar charts were created to explore the time that forest fires occurred in each sub district. The charts were linked to the map and they would show up with a click on each sub district polygon.

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### III. RESULTS AND DISCUSSION

The current version of the map is now available on the website http://www.lampangok.com/science/ForestFire/ZeroFireCR/.

The map is generated from new data in each sub district. It shows distinctive colors of different numbers of fire incidences in certain sub district each year. The map indicates areas which are in high risk (Fig. 1). Each forest fire point, which is originally indicated in latitude and longitude, is drawn on the map. Users are able to select each point to explore specific properties of each forest fire point in this program based on Google API. (Fig 2) With Google API, an individual forest fire spot is investigated more closely in many aspects, such as where the fires often occur, where the fires never occur and what the elevations of the fire spot are (by using Google’s map elevations). The surface cover of the land where the fires mostly occur is also inspected with this program. Moreover, users can observe the land cover of where the fire most occurring. In this program, the visualized statistical charts represent the periods in which the fires occur in certain sub districts. The graph illustrates the periods in months to define the vulnerable rates of fires. (Fig 3) The system encourages conception of fire patterns by extending a data base provided by the government administration. Furthermore, the system may help the government to plan or to manage budgets in solving fire problems in the northern Thailand more effectively in the future.

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### IV. CONCLUSION

In this study, the forest fire data retrieved from a NASA website is combined with the administrative data in a computerized process. The derived data from the process, then, is visualized in a map to create the practical tool to show forest fires in the ever smallest scale, sub-district. The map may operatively help solve problem from forest fires in the future.

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### REFERENCES


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