

DESIGN OF A FOSS GIS TOOL FOR WILDFIRE SPREAD SIMULATION, FIRE SUPPRESSION RESOURCE MANAGEMENT AND RISK ANALYSIS

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ABSTRACT

Wildfire simulation require of many geographical and georeferenced datasets. Integrating all of the processes for simulation into a GIS seems natural, but most of the solutions available are closed source, do not use standards and can't be arranged or modified to cover new requirements such as the integration of fire suppression activities into a fire spread simulator. GisFire is an under development open source tool integrated into QGIS that uses the standard OGC formats, uses GIS APIs and provides a set of APIs and procedures to interact with a fire spread simulator. The GisFire APIs also provides a set of tools to evaluate different fire spread simulators, different fire suppression resources management policies and strategies and evaluate personal or economical risks. This poster presents the design of the fire spread simulation tool integrated into QGIS to focus research into wildfire simulation and analysis.

1 INTRODUCTION

This poster presents the design of a new set of tools called GisFire, which is a wildfire related FOSS software framework, integrated into QGIS, a state of the art FOSS GIS software. Wildfire behavior prediction through simulation models has been in constant evolution. Since the first models described by McArthur (1966) and Rothermel (1972) many models and its correspondent simulation tools have been developed.

All simulation tools, such as FARSITE (Finney 1996), Prometheus (Tymstra et al. 2010), Phoenix (Tolhurst et al. 2008) and many others reviewed by Papadopoulos and Pavlidou (2011) integrate geographical and georeferenced data independently of the characteristics of the simulation models. Simulation tools or end users have to deal with data from different origins with different formats and different coordinate reference systems that have to be converted or re-projected. Also data with different nature, as vectorial data (for example vegetation land cover) or raster (for example height and slopes) have to be combined. Geographical Information Systems (GIS) cover all of the previous described aspects and many more. Also, GIS systems provide a graphical user interface.

A rapid and substantial shift in the occurrence of wildfire events due to the climate change described by Moritz et al. (2012) will lead into an increase of the number of events in warm areas. This fact makes more important that wildfire spread simulation tools have interoperability with other systems. Making wildfire simulation tools able to communicate with other models in order to include firefighting resources deployment, ground fire suppression, aerial fire suppression, logistic operations and supply chain among other new capabilities among others will help in taking better decisions.

2 THE GISFIRE TOOL

The main concept behind the development of GisFire tool pops up a question: If firefighting, forest and environmental agencies use every day GIS tools to calculate the wildfire risk index, the drought index, the relative humidity map, or any other measures and variables, why, if they want to simulate a wildfire event, they have to export all the necessary data from a GIS and use it in another different environment instead of using directly the same GIS they are used to work with.

Our answer of this question is to develop and integrate a wildfire simulator inside a GIS. However, since there is not a universal GIS, the first choice to make is to choose a GIS. As a public university, we enforce to develop open source tools, so an open source GIS is a natural selection. QGIS has been the selected tool since it implements a plug-in system with a huge ecosystem, GIS Geography (2018) It is also multi-platform and its plug-ins can be developed in both python or C++ making it suitable for CPU-consuming algorithms as wildfire simulation model implementations are. After the selection of technologies, the GisFire tool is a multi-platform plug-in for QGIS written in python with C++ bindings.

3 GISFIRE DESIGN

The GisFire tool implements different features developed in collaboration with the firefighting agency of Catalonia (Bombers de la Generalitat de Catalunya). The target of the tool involve the operational and formative tasks of the firefighting agency and does not cover tactic or long-term planning operations. The first implementation results of the GisFire wildfire simulation module are:

- Surface and Crown fire
- Fire acceleration
- Spotting

The collection of data using standard web services (WMS, WFS), files (ShapeFiles, GeoJSON) and REST services was implemented to provide data to the simulator. The user interface also includes personalization tools to provide, for example, a dictionary to fit vegetal cover to Rothermel surface models.

Each time step in the simulation process is represented by a different layer in the GIS application, so a fine analysis of the wildfire evolution and burned surfaces can be performed. All information generated by the wildfire simulation is stored in a PostGIS so different agencies can use the results with its GIS tool.

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